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The Relationship between Individual Characteristics and Safety Climate with Safety Behavior of Loading and Unloading Workers

A Study at Tenau Port, Kupang City, Indonesia

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ABSTRACT

Occupational safety is a crucial aspect of loading and unloading activities at ports, which inherently carry high levels of risk. This study aimed to analyze the relationship between individual characteristics and safety climate with safety behavior among loading and unloading workers at Tenau Port, Kupang City. A quantitative study with a cross-sectional design was conducted among loading and unloading workers at Tenau Port. The study population consisted of all active workers registered in the TKBM Cooperative, and a sample of 73 respondents was selected using a random sampling technique. Data were collected using structured questionnaires and analyzed using Chi-Square and logistic regression tests. The results showed that most respondents had good individual characteristics (82.2%) and perceived a strong safety climate (74.0%). Bivariate analysis indicated a significant relationship between individual characteristics and safety behavior ($p = 0.029$) as well as between safety climate and safety behavior ($p = 0.008$). Multivariate analysis showed that safety climate was the most dominant factor associated with safety behavior ($p = 0.038$; Exp(B) = 5.312; 95% CI = 1.101–25.634). Workers who perceived a stronger safety climate were more likely to demonstrate compliant safety behavior than those who perceived a weaker safety climate. In conclusion, individual characteristics and safety climate were significantly associated with safety behavior among loading and unloading workers at Tenau Port, Kupang City. Strengthening workplace safety culture and improving

workers' competencies are recommended to enhance safety compliance.

Keywords
Individual Characteristics
Safety Climate
Safety Behavior
Stevedores
Tenau Port

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Introduction

Occupational safety is a crucial aspect in various industrial sectors, particularly in high risks environments such as loading and unloading activities at ports. These activities involve intensive physical work, the use of heavy equipment, and interaction with various types of materials that can potentially harm workers [1]. Therefore, creating a safe work environment and practicing good safety behaviors among workers is essential to prevent accidents.

Workplace accidents remain common. Data from the International Labour Organization (ILO) shows that in 2018 there were more than 1.8 million work-related deaths, and globally, 2.78 million people die annually from work-related accidents or diseases (ILO, 2018). In Indonesia, the Social Security Agency (BPJS Ketenagakerjaan) recorded 123,041 cases in 2017, increasing to 173,105 cases in 2018, then 114,000 cases in 2019, and 177,000 cases in 2020. From January to December 2024, 462,241 cases of work-related accidents were recorded in Indonesia, including 530 cases in East Nusa Tenggara. Allianz Global Corporate & Specialty (AGCS, 2014) ranked Indonesia first in total losses due to work-related accidents, with 296 cases related to loading and unloading.

Ports, as transportation hubs, play a strategic role in the economy. However, stevedoring workers, who play a vital role in ensuring the smooth flow of goods, are the group most vulnerable to accidents [2]. The level of safety at ports is influenced by many factors, including individual worker characteristics. These characteristics include age, education, work experience, and health status, which determine workers' awareness and ability to follow safety procedures [3].

Furthermore, a safety climate is also crucial. *Safety climate* reflects employees' shared perceptions of the importance of safety, emphasized by the organization through policies, procedures, and practices. A work environment with a positive safety climate is characterized by management commitment, effective risk communication, and support for safe behavior [4]. In the port context, this is crucial for encouraging consistent worker safety behavior.

Despite various efforts, workplace accidents still occur. One cause is the suboptimal implementation of safety behaviors. Some workers still ignore procedures due to rushing, lack

of understanding, or work pressure. This situation highlights the important role of individual characteristics and safety climate in shaping safety behavior [5]. Differences in individual characteristics cause each worker to respond differently to risk. Younger workers tend to be energetic but less vigilant, while older workers are more experienced but physically vulnerable. Education determines the extent to which safety procedures are understood, and work experience forms habits that can strengthen or weaken safety awareness [6].

On the other hand, safety climate influences safety culture. A work environment that emphasizes safety encourages employee discipline, supported by communication, training, and fair sanctions and rewards. Strong management commitment will motivate employee compliance; conversely, if safety is considered a formality, employees tend to ignore it [7].

Although various studies have shown that individual characteristics and safety climate are associated with worker safety behavior in the construction, manufacturing, oil and gas, and other high-risk industries, information on the relationship between these two factors in port stevedoring workers is relatively limited. Research specifically examining safety climate and safety behavior in stevedoring workers in East Nusa Tenggara and Eastern Indonesia is also scarce. Most previous research was conducted in the manufacturing, construction, and oil and gas sectors, thus differing in occupational risk characteristics, supervision patterns, and operational conditions from port work environments. Therefore, there remains a gap in knowledge regarding how individual characteristics and perceptions of safety climate relate to the safety behavior of stevedoring workers in the port context of Eastern Indonesia.

Tenau Port, Kupang, was chosen as the research location because it is the main port in East Nusa Tenggara Province and serves as a gateway for interregional logistics distribution. The high loading and unloading activity, with a container volume reaching over 83,000 TEUs in 2022, indicates high work intensity and potential exposure to occupational hazards for stevedoring workers. Furthermore, preliminary survey results and occupational health data indicate that workers are still not optimally using personal protective equipment, are not adhering to safety procedures, and have high rates of musculoskeletal disorders (MSDs) and work fatigue. These conditions indicate factors that may influence worker safety behavior and require further investigation.

Data on loading and unloading volumes were obtained from the 2022 operational report of the Port of Tenau, Kupang, while data on musculoskeletal disorders and work fatigue came from an occupational health survey conducted among stevedoring workers. The high incidence of MSDs and work fatigue has the potential to reduce worker concentration, alertness, and compliance with safety procedures, thereby increasing the risk of workplace accidents. Therefore, these conditions are relevant to be linked to worker safety behavior in this study.

The novelty of this research lies in examining the relationship between individual characteristics and safety climate on safety behavior among stevedoring workers at the Port of Tenau, Kupang, a major port in the East Nusa Tenggara region. To date, similar research on stevedoring workers in Eastern Indonesia is very limited. The results of this study are expected to provide empirical evidence regarding factors related to worker safety behavior and become a basis for developing programs to improve work safety culture in the port environment.

The phenomenon at ports demonstrates that significant challenges remain in developing safety behavior. Therefore, in-depth research is needed to understand the influence of individual characteristics and safety climate on safety behavior. This research is expected to provide a clear picture of the relationship between these two factors, as well as a basis for safety improvement strategies [7]. Occupational safety is not just an individual responsibility, but a collective responsibility between workers, management, and all relevant parties. A safety culture requires ongoing collaboration through training, provision of personal protective equipment (PPE), improved procedures, and regular evaluations. This way, ports can become productive and safe workplaces.

Tenau Port, Kupang, in East Nusa Tenggara Province, recorded a loading and unloading volume of over 83,000 TEUs in 2022, with a high risk of workplace accidents. Initial observations indicate that some workers are not optimally using PPE, adhering to procedures, or receiving training. Individual characteristics such as age, education, experience, and motivation are suspected to influence compliance. Meanwhile, the safety climate is considered insufficient, as safety oversight remains incidental.

Although Tenau Port has implemented an Occupational Health and Safety Management System (SMK3) and achieved certification and a gold flag, field data shows that 80.6% of stevedoring workers experience *musculoskeletal disorders* (MSDs) and 69.4% experience work fatigue. This fact indicates that the implementation of occupational safety is not yet fully effective. Therefore, research on the relationship between individual characteristics and safety climate with worker safety behavior is crucial. The research results are expected to contribute to strengthening the occupational safety culture at Tenau Port, Kupang. Based on this phenomenon, the researcher is interested in raising a topic entitled "The Relationship between Individual Characteristics and Safety Climate with Safety Behavior among Loading and Unloading Workers at Tenau Port, Kupang City**".**

Methods

A. Research Design

This study uses a quantitative approach with a cross-sectional design through a survey, where data collection is carried out simultaneously at a certain time. Primary data were obtained from stevedoring workers at the Port of Tenau, Kupang City through direct

observation and questionnaire distribution, while secondary data came from occupational safety documents, internal port reports, employment regulations, and relevant supporting literature related to safety climate and worker characteristics. This study was conducted in July–August 2025 at the Port of Tenau, Kupang City. The study population was all stevedoring workers registered as members of the TKBM Cooperative and still active until February 2025, a total of 276 people. The sampling technique used was *random sampling.* The method used to determine the sample size is the Slovin formula. Thus, in this study, the sample consisted of 73 stevedoring workers at Tenau Port, Kupang City, East Nusa Tenggara.

B. Data Collection and Instruments

Data collection was conducted through observation and questionnaires. Observations were used to directly observe the implementation of occupational safety principles, such as the use of PPE, adherence to procedures, and implementation of safety instructions. The research instrument used a structured questionnaire based on Safety Climate theory and Safety Behavior concept, which was then modified to reflect the characteristics of loading and unloading work. Individual characteristics were measured using 10 items covering occupational safety knowledge, attitudes toward safety, work motivation, work experience, and awareness of occupational risks. Safety climate was measured using 12 items covering commitment to safety management, safety communication, safety training, safety supervision, availability of personal protective equipment, and worker participation in safety programs. Safety behavior was measured using 10 items covering compliance with personal protective equipment use, adherence to safe work procedures, reporting unsafe conditions, participation in safety activities, and workplace accident prevention behavior. Each item used a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. Negative statements were reverse scored before analysis.

Examples of safety climate indicators include: "Management always prioritizes work safety over job targets" and "Workers receive sufficient safety information before performing work". Examples of safety behavior indicators include: "I always use PPE according to work standards" and "I report work conditions that have the potential to cause accidents". Before being used in the study, the instrument was tested for validity and reliability on 30 respondents with characteristics similar to the study population. The validity test results showed that all items had corrected item-total correlations greater than 0.361, thus being considered valid. The corrected item-total correlations for individual characteristics variables ranged from 0.412–0.781, safety climate variables ranged from 0.438–0.824, and safety behavior variables ranged from 0.457–0.803. The reliability test results showed Cronbach's Alpha values of 0.821 for individual characteristics variables, 0.887 for safety climate variables,

and 0.853 for safety behavior variables. All variables had a Cronbach's Alpha value greater than 0.70, thus being deemed reliable.

C. Data Analysis

Categories were determined based on the percentage of respondent's scores compared to the maximum score. Individual characteristics and safety climate were categorized as weak (<60%), moderate (60–79%), and strong (≥80%). Safety behaviors were categorized as less compliant (<60%), moderately compliant (60–79%), and highly compliant (≥80%).

The data obtained were processed through *editing, coding, entry, cleaning,* and *tabulating* using the SPSS (*Statistical Package for the Social Sciences*) application. The analysis was carried out univariately, bivariately, and multivariately. Univariate analysis was used to describe the distribution of variables, bivariate analysis to test the relationship between independent variables (age, education, length of service, and safety climate) with the dependent variable (safety behavior) using the Chi-Square test, while multivariate analysis was used to determine the dominant factors that influence worker safety behavior. With this approach, the study is expected to be able to provide an empirical picture of the relationship between individual characteristics and safety climate on safety behavior at Tenau Port, Kupang.

Results

A. Characteristics of Respondents

Table 1 describes the demographic characteristics of the study participants. Most respondents were aged 21–29 years (75.3%), followed by those aged 30–39 years (20.5%) and under 20 years (4.1%). All participants were male (100.0%). Regarding educational attainment, the majority had completed senior high school (56.2%), followed by a bachelor's degree (26.0%), junior high school (9.6%), and elementary school (8.2%).

Table 1. Characteristics of Respondents

Variables	Frequency	Percentage
Age		
• < 20 years	3	4.1
• 21–29	55	75.3
• 30–39	15	20.5
Gender		
• Man	73	100.0
• Woman	0	0.00
Attained Education		
• Elementary School	6	8.2
• Junior High School	7	9.6
• Senior High School	41	56.2
• Bachelor	19	26.0
Total	73	100

B. Univariate Test

Table 2 presents the distribution of participants according to safety climate and safety behavior. Most respondents perceived a strong safety climate (74.0%), while 15.1% reported a moderate safety climate and 11.0% a weak safety climate. Regarding safety behavior, over half of the participants were quite compliant (53.4%), 43.8% were very compliant, and only 2.7% were less compliant, indicating generally positive workplace safety conditions and practices.

Table 2. Univariate Test Results

Variables	Frequency	Percentage
Safety Climate		
• Weak	8	11.0
• Currently	11	15.1
• Strong	54	74.0
Safety Behavior		
• Less Compliant	2	2.7
• Quite Compliant	39	53.4
• Very Compliant	32	43.8
Total	73	100

Based on the safety climate distribution, the majority of respondents (54 respondents) perceived the work safety climate as strong, with 74.0% of respondents categorizing it as moderate, followed by 11 (15.1%) and 8 (11.0%). These results indicate that the majority of respondents assessed the work environment as adequately supporting the implementation of work safety. Based on safety behavior, the majority of respondents (53.4%) were categorized as moderately compliant, with 32 (43.8%) categorizing it as highly compliant, and 2 (2.7%) categorizing it as less compliant. These results indicate that the majority of workers demonstrated adequate work behaviors in implementing work safety aspects during port activities. Based on length of service at the port, the majority of respondents (80.8%) had worked for 1–3 years, with 7 (9.6%) respondents having worked for less than 1 year and 4–6 years, respectively. This indicates that the majority of respondents had sufficient work experience in port loading and unloading activities.

Based on their job titles in loading and unloading, the majority of respondents worked as porters (54 people, 74.0%), followed by heavy equipment operators (8 people, 11.0%), field supervisors (7 people, 9.6%), and other positions (4 people, 5.5%). These results indicate that the composition of respondents is dominated by workers directly involved in loading and unloading activities, thus having greater exposure to occupational safety risks.

C. Bivariate Test

Table 3 presents the associations between individual characteristics, safety climate, and compliance level. The analysis showed significant relationships between individual characteristics and compliance (p = 0.029) and between safety climate and compliance (p =

0.008). Participants with better individual characteristics and those who perceived a stronger safety climate tended to demonstrate higher levels of compliance, suggesting that both personal and organizational factors contribute to safety-related behavior.

Table 3. Bivariate Test Results

Variables	Compliance Level, n (%)			Number n	p-value
	Less	Quite	Very		
Individual Characteristics					
• Weak	2 (16.7)	8 (66.7)	2 (16.6)	12	0.029*
• Pretty good	0 (0.0)	1 (100.0)	0 (0.0)	1	
• Good	0 (0.0)	30 (50.0)	30 (50.0)	60	
Safety Climate					
• Weak	2 (25.0)	6 (75.0)	0 (0.0)	8	0.008*
• Currently	0 (0.0)	5 (45.5)	6 (54.5)	11	
• Strong	0 (0.0)	28 (51.9)	26 (48.1)	54	
Total	2 (2.7)	39 (53.4)	32 (43.8)	73	

Based on the results of the crosstab analysis between individual characteristics and safety behavior, there are differences in the distribution of safety behavior in each individual category. Respondents in the good category mostly showed fairly compliant or very compliant behavior, as many as 30 people each, while only a few respondents with weak characteristics were included in the less compliant or very compliant categories. The percentage shows that of the total 73 respondents, 82.2% were classified as good characteristics, 16.4% were weak, and 1.4% were quite good. The Chi-Square test produced a p-value = 0.008, indicating a significant relationship between individual characteristics and safety behavior. This indicates that the level of compliance with safety procedures is influenced by individual characteristics, where individuals with good characteristics tend to be more compliant.

Furthermore, the relationship between Safety Climate and Safety Behavior was also analyzed. The crosstab results show that respondents in the strong category tend to have fairly compliant and very compliant behavior, while respondents in the weak category have more varied behavior, including some who are less compliant. Of the total 73 respondents, the majority (74%) are in the strong safety climate category, 15.1% are moderate, and 11% are weak. The Chi-Square test produced a p-value = 0.029, which indicates a significant relationship between safety climate perceptions and safety behavior. This finding confirms that a work environment that supports safety can increase worker compliance with safety procedures.

Overall, these results emphasize the importance of individual characteristics and perceptions of safety climate in determining safety behavior. Interventions such as training and strengthening of safety culture are expected to improve worker compliance, particularly for those with less-than optimal individual characteristics or those in a weak safety climate.

D. Multivariate test

The requirement for a variable to enter the logistic regression analysis is a p-value <0.25. Therefore, the variables included in the multivariate analysis are age (p-value = 0.047), individual characteristics (p-value = 0.050), and *safety climate* (p-value = 0.038). The results of the first step of the logistic regression analysis show that the age variable has a p-value of 0.047, meaning it is not significant because the p-value is <0.05. The individual characteristics and *safety climate* variables have p-values of 0.050 and 0.038, respectively, meaning that only one of them is significant, namely *safety climate* and is the most dominant. because p value < 0.05.

Table 4. Multivariate Test Table

Variables	p-value	Exp (B)	95% CI	
			Lower	Upper
Safety Climate	0.038	5.312	1.101	25.634

Table 4 represents the final step of the logistic regression analysis and serves as the final model for the multivariate analysis. The results of the multivariate analysis indicate that the variable most closely related to the outcome is *safety climate*, with a p-value of 0.038 and Exp(B) of 5.312 (95% CI: 1.101–25.634). This indicates that *Safety Climate* has a significant relationship with the dependent variable, while the other variables are not significant at the p < 0.05 test level.

Discussion

A. The Relationship Between Individual Characteristics and Safety Behavior

The safety behavior of stevedoring workers at ports is strongly influenced by the individual characteristics inherent in each worker. These characteristics include age, gender, education, work experience, as well as psychological and motivational factors [8], [9]. Individual characteristics determine workers' attitudes, motivation, and compliance with work regulations, including safety procedures [10], [11]. The results of the study showed that the majority of stevedoring workers had good individual characteristics (82.2%), while only a small portion were in the weak (16.4%) and fairly good (1.4%) categories. The crosstab showed that workers with good characteristics more consistently demonstrated safety behaviors ranging from "Quite Compliant" to "Very Compliant," while weak characteristics tended to be associated with less compliant behavior. The Chi-Square test yielded p = 0.008, proving a significant relationship between individual characteristics and safety behavior.

These findings align with Geller's theory, which states that individuals with positive attitudes, adequate knowledge, and high motivation are more compliant with safety regulations. In the port context, experienced workers have better risk awareness than new workers, resulting in more consistent implementation of safety procedures [12], [13]. Recent research supports these findings: several previous researchers highlight the role of education,

emphasize the influence of age and length of service, the importance of psychological factors such as self-efficacy and optimism [14]-[17].

Thus, individual characteristics have been shown to influence safety behavior. Port management needs to strengthen these factors through training, mentoring for new workers, and motivational programs to improve safety compliance [18]. This will contribute to reducing workplace accidents and strengthening the safety culture at Tenau Port.

B. The Relationship Between Safety Climate and Safety Behavior

The results of the multivariate analysis indicate that safety climate is the most dominant factor related to safety behavior compared to other factors. This finding indicates that the safety behavior of stevedoring workers is not only determined by individual characteristics, but is more influenced by the conditions of the work environment and the safety system established by the organization [19], [20]. In the context of the Port of Tenau Kupang, initial observations indicate that safety supervision is still incidental and not consistently implemented in every loading and unloading activity. This condition causes workers to rely more on the work culture that develops in the field than on established formal safety regulations. When workers perceive management commitment to safety, adequate supervision, good risk communication, and the availability of adequate safety facilities, the tendency to behave safely becomes higher [21]. Safety climate reflects an organization's safety culture, where workers will be more disciplined if management provides clear direction, supervision, and rewards [7]. Zohar added that safety climate strengthens collective interaction, where workers remind each other to prevent procedural violations [17]. Recent research is also consisten [22] proved that safety climate improves safety performance, Xi et al. [23] demonstrated its effect through increased safety consciousness. Safety climate and safety knowledge influence safety behavior as mediators of overall performance [24]-[27].

The implication is that port managers need to strengthen the safety climate through strategies such as regular training, safety system evaluations, open communication between management and workers, and rewards for compliant workers [28]. These efforts will foster a sustainable safety culture. With a strong safety climate, workers are more motivated to maintain the safety of themselves and their colleagues, thereby minimizing the risk of accidents [29].

Conclusion

Individual characteristics and safety climate were significantly associated with safety behavior among loading and unloading workers at Tenau Port, Kupang City. In the multivariate analysis, safety climate was the factor most strongly associated with safety behavior. Workers who perceived a stronger safety climate had higher odds of demonstrating compliant safety behavior compared with workers who perceived a weaker safety climate. These findings

highlight the importance of strengthening workplace safety climate alongside efforts to improve worker competencies and safety awareness.

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