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The Influence of Work Discipline Systems on Perceived Accident Risk and Unsafe Behaviors in Ship Loading and Unloading Operations

Asteria Narulita Pramana[1]*, Muh. Fauji[1], Sahrul[1]

1. Safety Engineering, Faculty of Maritime Affairs, IVET University Semarang, Semarang, Indonesia

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Abstract

Work discipline plays a vital role in preventing accidents during coal loading and unloading activities on ships. This study aims to analyze the influence of the disciplinary system on the risk of ship-loading and unloading accidents at PT SMD in Semarang. The method used was quantitative research with a cross-sectional survey design. Given that the total population of truck drivers at PT SMD was exactly 55, we employed total population sampling, examining all available workers. Data collection used a Likert scale questionnaire. Statistical tests included validity, reliability, normality (One-Sample Kolmogorov-Smirnov), and simple linear regression. All 10 items of the discipline instrument were declared valid ($r > 0.3$) with a Cronbach's alpha of 0.927 (very high). Of the 10 items of the loading and unloading instrument, 9 were valid and had a reliability of 0.874 (high). The normality test showed Asymp. Sig. = 0.200 (> 0.05), meeting the assumption of a normal distribution. The ANOVA test results showed Sig. = 0.000 (< 0.05), indicating the regression model is significant. The discipline system significantly influences the risk of ship loading and unloading accidents; the higher the level of worker discipline, the lower the risk of such accidents.

Keywords

Coal loading and unloading, Workplace accidents, Occupational safety, Discipline system

Correspondence
Asteria Narulita Pramana
Safety Engineering, Faculty of Maritime Affairs,
IVET University Semarang,
Semarang 50188, Indonesia.
Email: asterianarulita@gmail.com

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1. BACKGROUND

Human resources play a crucial role in the smooth operation of maritime transportation. Ships are a vital means of maritime transportation, playing a crucial role in global distribution, including in Indonesia, a maritime nation with a significant portion of its territory covered by water. Therefore, smooth operations, particularly in the loading and unloading of ships, are inseparable from discipline. Truck drivers involved in loading and unloading must work diligently to avoid the risk of workplace accidents (Palapa & Sulkha, 2021).

While the relationship between work discipline and workplace safety has been extensively studied in general occupational settings, there remains a critical gap in understanding this relationship within the specific context of coal loading and unloading operations at Indonesian ports. Previous studies have primarily examined the effect of discipline on overall employee performance (Idrus et al., 2021; Salsabiila & Hidayati, 2023), but few have investigated how discipline systems influence perceived accident risk and self-reported unsafe behaviors among truck drivers in maritime cargo operations. This study addresses this gap by: (1) examining discipline within the under-researched context of coal loading operations at a specific port type in Indonesia; (2) focusing on perceived risk and unsafe behavior tendencies rather than general performance outcomes; and (3) controlling for demographic factors (age, education, work experience) that may moderate the discipline-risk relationship in this high-risk occupational group.

In general, workplace discipline shapes optimal company performance, influenced by both internal and external factors (Hidayati & Putri, 2022). Workers and employees are valuable assets for every company, organization, and government agency. A person's purpose in working is primarily driven by the needs of life that must be met, and employees will work according to their respective capacities.

Employee discipline significantly influences the creation of a conducive work environment, which, in turn, increases motivation to complete tasks. Hasibuan (2002) explains that work discipline is an individual's awareness and willingness to comply with all applicable regulations and existing social norms. Awareness reflects an individual's voluntary adherence to regulations and awareness of their responsibilities and duties. Meanwhile, willingness encompasses employee behavior and actions in implementing company regulations, both written and unwritten (Hidayat et al., 2024). Work discipline is one of the most important operational functions in human resource management because the higher an employee's level of discipline, the more optimal their performance can be (Singodimedjo, 2019). If all employees are disciplined and adhere to time and regulations, the risk of workplace accidents can be minimized (Sutrisno, 2017). Leaders must be firm and tactful when dealing with loading and unloading truck drivers to ensure good work discipline is maintained.

A work accident is an unexpected, unintentional incident in the workplace

that has the potential to cause harm, including physical injury, damage to assets, or even death to workers. The most common factors contributing to accidents include age, gender, education level, work experience, psychological conditions, and the interaction between workers and the work environment (Tri Handari & Qolbi, 2021). Loading and unloading activities are among the jobs with the highest accident risk in port operations. Field observations at PT SMD indicate that truck drivers sometimes fail to use personal protective equipment (PPE) and are careless during coal unloading. This aligns with Mr. Ardianto's statement, Manager of PT Samudra Moda Indonesia, that at work, especially during loading and unloading, implementing safety practices, such as wearing PPE and being careful, must become a habit.

Research by Idrus et al. (2021) found that work motivation and work discipline have a positive and significant effect on employee performance at PT Industri Kapal Indonesia. Salsabiila & Hidayati (2023) also found that discipline has a positive and significant effect on employee performance ($t = 0.000 > 0.05$). Based on this background and the identified research gap, this study aims to analyze the influence of the discipline system on perceived accident risk and tendencies toward unsafe behavior during ship loading and unloading operations at PT Samudra Moda Indonesia in Semarang, while controlling for demographic variables.

2. METHODS

This study used a quantitative, positivist approach. Data were collected through questionnaires, while statistical analysis was conducted to test the established hypotheses (Sugiyono, 2019). The study population comprised all 55 truck drivers employed by PT SMD involved in coal loading and unloading operations. Given that the total population was small and accessible ($N = 55$), we employed total population sampling (also known as saturated sampling), examining the entire population rather than drawing a sample (Sekaran & Bougie, 2016). This approach eliminates sampling error and is appropriate when the population is small and homogeneous. Using total population sampling rather than incidental sampling ensures that all eligible workers have an equal opportunity to participate, reducing selection bias. In this study, two variables were measured: the independent variable, Work Discipline System (X), and the dependent variable, Loading and Unloading Accident Risk (Y). Each variable was measured using 10 statements

with a Likert scale: Strongly Agree (5), Agree (4), Disagree (3), Disagree (2), and Strongly Disagree (1) (Ardianti, 2024). Content validity was assessed through expert judgment by four individuals with scientific backgrounds in Occupational Safety and Health (K3), comprising two lecturers and two senior practitioners at PT SMD. The statistical analysis carried out included: (1) Item validity test with a corrected item-total correlation value › 0.3 declared valid (Azwar, 2019); (2) Reliability test with a Cronbach's alpha value › 0.6 indicates a reliable instrument (Hartono, 2020); (3) Normality test using the One-Sample Kolmogorov-Smirnov Test; data with Asymp. Sig. › 0.05 declared normally distributed (Hartono, 2020); (4) Simple linear regression test ANOVA was used to test the significance of the regression model; a Sig. value ‹ 0.05 indicates a significant model.

3. RESULTS

This study used instruments that had been tested through statistical validity and reliability tests to ensure data accuracy and consistency. The validity test results showed that all items (1-10) met the validity criteria, with coefficient values exceeding 0.3. This indicates that each item accurately measures the intended aspect (Table 1).

Table 1. Validity Test on Work Discipline Indicator Statistics

No	Scale Mean if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ITEM1	35.24	.637	.923
ITEM2	35.62	.753	.918
ITEM3	35.53	.637	.924
ITEM4	35.25	.706	.920
ITEM5	35.42	.765	.917
ITEM6	35.42	.779	.916
ITEM7	35.20	.774	.917
ITEM8	35.40	.803	.916
ITEM9	35.45	.578	.926
ITEM10	35.42	.756	.917

Based on the reliability test results presented in Table 2, all research instruments were declared reliable, with reliability coefficients ›0.7. This indicates that the instruments used have good internal consistency, making them reliable for measuring research variables consistently. Therefore, each item in the instrument produced stable and valid data when used in this study.

Table 2. Work Discipline Reliability Test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.927	.927	10

Based on the validity test results for the Loading and Unloading instrument presented in Table 3, one item was deemed invalid due to its coefficient value being less than 0.3. This likely occurred because respondents responded hastily, inaccurately, or did not read the questions thoroughly, leading to responses that did not accurately reflect the intended aspect. Meanwhile, the other items demonstrated validity values that met the criteria, so the instrument remained usable for research data analysis.

Table 3. Validity Test of Loading and Unloading Indicators

ITEM	Scale Mean if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ITEM1	33,22	.632	.859
ITEM2	33,42	.484	.870
ITEM3	33,42	.723	.855
ITEM4	33,80	.762	.848
ITEM5	33,40	.719	.851
ITEM6	33,47	.698	.853
ITEM7*	34,00	.294	.887
ITEM8	33,45	.691	.855
ITEM9	33,35	.768	.849
ITEM10	34,09	.324	.885

**ITEM7 is invalid (Corrected Item-Total Correlation < 0.3)*

Based on the reliability test results presented in Table 4, all instrument items had reliability coefficients exceeding 0.7. This indicates that the instrument has good internal consistency, resulting in stable, reliable responses from respondents. In other words, this instrument can measure research variables consistently across respondents, providing a strong foundation for accurate subsequent data analysis.

Table 4. Loading and Unloading Reliability Test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.874	.881	10

The normality test using the One-Sample Kolmogorov-Smirnov Test yielded an Asymp. Sig. (2-tailed) value of 0.200, which is greater than 0.05. Thus, the data are normally distributed and meet the assumptions for linear regression analysis (Table 5).

Table 5. Kolmogorov-Smirnov Normality Test

		Unstandardized Residual
N		55
Normal Parametersa, b	Mean	.0000
	Std. Deviation	3.739
Most Extreme Differences	Absolute	.058
	Positive	.055
	Negative	-.058
Test Statistic		.058
Asymp. Sig. (2-tailed)		.200c, d

The data distribution is Normal.

The ANOVA test on simple linear regression yielded a Sig. value of 0.000 (<0.05), meaning the regression model was significant. This indicates that the discipline system significantly influences the risk of ship loading and unloading accidents (Table 6).

Table 6. Simple Linear Regression Test - Effect of Discipline on the Risk of Loading and Unloading Accidents

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	2728.404	1	2728.404	191.545	.000b
Residual	754.942	53	14.244		
Total	3483.345	54			

a. Dependent Variable: Loading and Unloading; b. Predictor (Constant): Discipline

4. DISCUSSION

The empirical evidence from this study demonstrates that the implementation of a disciplinary system exerts a statistically significant influence on accident risk during ship loading and unloading operations, as evidenced by the simple linear regression analysis (Sig. = 0.000 < 0.05). This finding substantiates Hasibuan's (2019) theoretical framework, which posits that work discipline embodies an individual's conscious awareness and voluntary adherence to organizational regulations and prevailing social norms. Within the occupational

safety context, discipline emerges as a critical protective mechanism against workplace accidents, functioning through multiple pathways including enhanced procedural compliance, improved hazard recognition, and sustained adherence to safety protocols.

The negative and significant relationship between discipline and accident risk corroborates the findings of Palapa and Sulkha (2021), who reported a calculated t-value of 3.085, exceeding the critical t-value of 1.989 at the 0.003 significance level. This convergence of evidence across different occupational contexts strengthens the theoretical generalizability of discipline as a fundamental determinant of workplace safety outcomes. Furthermore, the positive association between discipline and employee performance documented by Salsabiila and Hidayati (2023), with a significance level of 0.000, suggests an indirect pathway through which discipline reduces accident risk: disciplined workers demonstrate superior task performance, thereby minimizing error-prone behaviors and procedural violations that precipitate accidents.

The mechanism underlying the discipline-accident relationship aligns with Bird and Germain's (2021) seminal finding that approximately 88% of workplace accidents originate from unsafe behaviors, while unsafe conditions account for merely 12%. This disproportionate attribution underscores the critical importance of behavioral interventions, particularly discipline enhancement, as a primary accident prevention strategy. A disciplined workforce systematically adheres to established operational protocols, including standardized loading and unloading sequences, pre-operational inspections of heavy equipment, and structured inter-crew communication systems. Such systematic adherence mitigates procedural deviations, which are the primary precursors to accidents in maritime cargo operations (Christian et al., 2021).

The field observation revealing that 21 out of 55 workers (38.2%) failed to comply with personal protective equipment requirements, including masks, helmets, and gloves, warrants particular attention. The predominance of junior high school education within this non-compliant subgroup illuminates a critical intersection between educational attainment, safety literacy, and disciplinary adherence. Workers with limited formal education often encounter difficulties comprehending written standard operating procedures and safety instructions, demonstrating reduced

responsiveness to conventional safety training methodologies, and exhibiting greater reliance on ingrained habitual practices rather than evidence-based safety principles (Notoatmodjo, 2022). This educational disparity suggests that disciplinary systems must be complemented by differentiated training approaches that accommodate varying literacy levels, utilizing visual demonstrations, peer modeling, and hands-on practice rather than exclusively text-based instruction.

The invalidity of Item 7 ("Training in loading and unloading is not important to me"), with a corrected item-total correlation of 0.294, reveals a nuanced discrepancy between the instrument's assumptions and workers' perceptions. This psychometric anomaly may reflect several underlying phenomena: workers might cognitively acknowledge the importance of training while behaviorally deprioritizing it; field supervisory practices might inadvertently signal that production speed supersedes training compliance; or the training content itself might lack perceived relevance to daily operational challenges. This finding necessitates a qualitative investigation to elucidate the cognitive and organizational factors shaping worker attitudes toward training, potentially revealing barriers to training effectiveness that quantitative instruments cannot capture.

The comprehensive accident prevention framework proposed by Nurmala et al. (2025) encompasses technological advancement, workforce skill development, stringent implementation of safety standards, environmental condition management, storage area optimization, periodic compliance monitoring, and regulatory adherence. Each of these dimensions fundamentally intersects with the implementation of the disciplinary system. Advanced technology requires disciplined operation and maintenance; skill upgrading demands disciplined participation in training programs; safety standards necessitate disciplined adherence; environmental management requires disciplined monitoring protocols; equipment management depends on disciplined inspection routines; compliance monitoring embodies disciplinary enforcement mechanisms; and regulatory adherence represents the ultimate manifestation of organizational discipline. This conceptual integration suggests that disciplinary systems function not as isolated interventions but as foundational enablers that amplify the effectiveness of complementary safety management strategies.

The practical implications of these findings extend beyond individual behavior modification to encompass organizational culture transformation. Effective disciplinary systems in maritime cargo operations require multi-level interventions, including visible management commitment to safety protocols, consistent enforcement mechanisms that apply equitably across all organizational levels, positive reinforcement systems that reward compliant behaviors rather than exclusively punishing violations, and participatory safety committees that engage workers in developing and refining disciplinary protocols. Such comprehensive approaches address both the behavioral and systemic dimensions of workplace safety, recognizing that individual discipline emerges from and is sustained by organizational structures, cultures, and leadership practices.

5. CONCLUSION

The work discipline system significantly influences the risk of accidents during coal loading and unloading activities at PT SMD, Semarang. The higher the level of employee discipline, the lower the risk of loading and unloading accidents, as evidenced by a simple linear regression test with a Sig. ANOVA value of 0.000 ‹ 0.05. Companies and port managers are advised to strengthen their discipline-monitoring system and ensure consistent use of PPE, conduct regular training, especially for new employees, drivers, and heavy equipment operators, and ensure that loading and unloading SOPs are understood by all workers. Future research is recommended to include additional variables, such as the quality of supervision and work environment conditions, to provide a more comprehensive understanding of the factors influencing the risk of workplace accidents in ship loading and unloading areas.

AUTHOR CONTRIBUTIONS

ANP, contributed to the development of research concepts, data collection, data processing and analysis, interpretation of research results, preparation and revision of the article manuscript. MF & S, contributed to research supervision, preparation of research methodology, validation of data analysis, as well as revision and refinement of the article manuscript

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest in this research.

DATA AVAILABILITY STATEMENT

The data the findings of this research are available from the corresponding author upon reasonable request.

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