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The Impact of Occupational Safety and Health on the Performance of Container Terminal Loading and Unloading Workers

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ARTICLE INFO

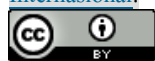
Keywords: Occupational Safety, Occupational Health, Worker Performance, Loading and Unloading Laborers

Received : 4 July 2026

Revised : 24 August 2026

Accepted : 25 September 2026

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ABSTRACT

This empirical study examines how occupational safety and health influence the operational performance of loading and unloading personnel at PT New Priok Container Terminal One (NPCT1), Tanjung Priok. Applying a quantitative causal-associative design, data were gathered from 80 active workers selected via Slovin's formula from a total population of 400 individuals and analyzed through multiple linear regression. Descriptive findings indicate that safety, health, and worker performance score within fairly good brackets. Partially, safety and health each exert a positive and significant impact on performance ($t=4.094$ and $t=6.433$; $p<0.001$). Simultaneously, both elements significantly drive performance variation ($F=849.088$; $p<0.001$), accounting for an R^2 of 0.957. These outcomes confirm that optimizing occupational safety and health is a vital catalyst for terminal efficiency.

INTRODUCTION

Global logistics distribution and supply chain velocity rely heavily on port operations, where loading and unloading tasks serve as core operational anchors. Contemporary port environments integrate advanced automation and heavy machinery, such as container cranes, to maximize turnaround speed and operational efficiency (International Labour Organization [ILO], 2022). Nevertheless, high-density equipment complexity and intense cargo mobility elevate occupational hazard probabilities for terminal personnel. Consequently, enforcing rigorous Occupational Safety and Health (OSH) standards is non-negotiable to safeguard physical well-being while sustaining stable workflow productivity (Rahmawati & Santoso, 2023).

Conceptually, OSH integrates systematic protective measures designed to mitigate workplace accidents and occupational illnesses. Safety protocols target physical hazard control and

adherence to standard procedures, whereas health practices maintain the physiological and psychological equilibrium of workers. Nationally, these principles are anchored in regulatory frameworks such as Law No. 1 of 1970 on Occupational Safety and Government Regulation No. 50 of 2012 regarding OSH Management Systems implementation.

Workforce performance reflects the degree to which operational responsibilities are fulfilled, evaluated across quality, quantity, timeliness, efficiency, and task accountability. Prioritizing robust OSH parameters alleviates psychological anxiety and diminishes incident exposure, enabling operators to maintain absolute focus on core duties. Operations at PT New Priok Container Terminal One (NPCT1) demand exceptional vigilance due to persistent exposure to heavy machinery and massive cargo payloads. Prior literature dictates that OSH implementation at NPCT1 must harmonize human

factors, operational instruments, and field conditions (Juniarto & Wibowo, 2021). Furthermore, corporate management routinely executes medical screenings and equipment compliance audits to satisfy regulatory benchmarks (NPCT1, 2025; Ministry of Transportation of the Republic of Indonesia, 2023).

Prior empirical investigations validate a strong correlation linking OSH provisions with employee performance elevation (Kuta & Rante, 2024; Wewo & Hidayat, 2024; Palit & Sendow, 2024). Nonetheless, empirical inquiries specifically testing the partial and simultaneous quantitative impacts of safety and health on port laborers within NPCT1 remain wide open for granular elaboration. Grounded in this background, this study aims to

evaluate the empirical influence of occupational safety and health on container terminal laborer performance at NPCT1 Tanjung Priok.

METHODS

This study adopts a quantitative methodology utilizing a causal-associative framework to test structural relationships among numerical variables via statistical procedures (Creswell & Creswell, 2023; Sugiyono, 2023). The research evaluates the influence of occupational safety (X₁) and occupational health (X₂) on laborer performance (Y) at NPCT1 Tanjung Priok. The research model can be illustrated as follows

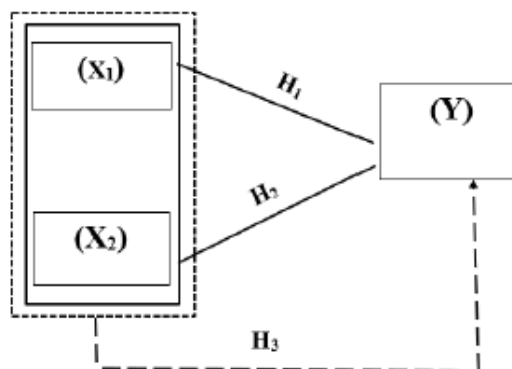


Figure 1. Research model

The population comprises 400 active loading and unloading personnel. Sample size determination employed Slovin's formula with a 10% error tolerance (Arikunto, 2022), yielding 80 respondents selected via purposive sampling based on active operational tenure, age criteria, and consent. Primary data were collected through structured 5-point Likert-scale questionnaires, supplemented by field observations and documentation. Research instruments underwent rigorous validity testing via Pearson Product-Moment correlation and reliability assessment through Cronbach's Alpha (Hair et al., 2019; Ghozali, 2024). Data processing utilized multiple linear regression analysis via statistical software (Priyatno, 2023), formulated as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + e$$

RESULTS AND DISCUSSION

Respondent Characteristics

This study involved 80 loading and unloading laborers (TKBM) drawn from a total population of 400 active operational personnel at PT New Priok Container Terminal One (NPCT1), Tanjung Priok. The respondents' profile covers age, gender, and length of service.

Regarding age distribution, the majority of respondents were over 32 years old, accounting for 47 individuals (58.8%), followed by the 28–32 age group with 15 individuals (18.8%), the 23–27 group with 11 individuals (13.8%), and the 17–22 group with 7 individuals (8.8%). This composition indicates that the respondents were predominantly mature workers with substantial working age experience.

In terms of gender, all respondents were male (80 individuals or 100%). This profile corresponds directly with the demanding nature of loading and

unloading operations, which require physical readiness, high mobility, and resilient stamina within terminal working environments.

Based on tenure, workers with a service length of 10–13 years constituted the largest group, numbering 21 individuals (26.3%), followed by those with 6–9 years of service (19 individuals or 23.8%), over 18 years (15 individuals or 18.8%), 14–17 years (13 individuals or 16.3%), and 2–5 years (12 individuals or 15.0%). This distribution demonstrates that most respondents possessed

extensive working experience in port handling activities.

Descriptive Analysis of Research Variables

Variable measurements utilized a five-point Likert scale, categorized as follows: mean scores of 1.00–1.80 represent "very poor", 1.81–2.60 "poor", 2.61–3.40 "fairly good", 3.41–4.20 "good", and 4.21–5.00 "very good". A summary of the descriptive statistics is presented in Table 1.

Table 1. Summary of Descriptive Statistics for Research Variables

Variable	Number of Items	Mean	Category
Occupational Safety (X_1)	8	3.32	Fairly Good
Occupational Health (X_2)	8	3.33	Fairly Good
Worker Performance (Y)	8	3.31	Fairly Good

Source: Processed Primary Data, 2026 (N = 80)

Table 1 demonstrates that all three variables fell into the fairly good category. Occupational Safety recorded a mean score of 3.32, Occupational Health stood at 3.33, and Worker Performance reached 3.31. These figures indicate that while respondents generally perceived the implementation of occupational safety and health programs, execution remains short of full optimization.

Within the Occupational Safety variable, the highest mean score appeared on indicator $X_{1.6}$ at 3.46 (good category), whereas indicator $X_{1.7}$ yielded the lowest mean at 3.26. Additionally, indicator $X_{1.4}$ warrants specific attention since 26 respondents (32.5%) expressed disagreement. This finding reveals divergent perceptions among respondents concerning the consistent implementation of safety measures in the field.

For the Occupational Health variable, the overall mean score was 3.33. Indicators $X_{2.3}$ and $X_{2.6}$ attained the highest ratings at 3.42 each, while $X_{2.5}$ recorded the lowest at 3.21. Consequently,

health protocols have functioned adequately overall, though specific dimensions require reinforcement to ensure equitable distribution of program benefits.

Meanwhile, Worker Performance registered a mean score of 3.31, placing respondent performance in the fairly good category. Indicator Y_3 achieved the highest mean score of 3.36, while Y_2 showed the lowest at 3.21. This condition highlights existing opportunities to elevate the quality and consistency of operational output among laborers.

Validity and Reliability Tests

Validity testing was performed using the Corrected Item-Total Correlation method. With 80 respondents and a 5% significance level, the critical r table value was 0.220. The results established that all statement items for Occupational Safety ranged between 0.881–0.917, Occupational Health between 0.881–0.922, and Worker Performance between 0.871–0.914. Because all values exceeded 0.220, all 24 statement items were declared valid.

Table 2. Summary of Validity and Reliability Tests

Variable	Corrected Item-Total Correlation Range	Cronbach's Alpha	Status
Occupational Safety (X_1)	0.881–0.917	0.973	Valid & Reliable
Occupational Health (X_2)	0.881–0.922	0.974	Valid & Reliable
Worker Performance (Y)	0.871–0.914	0.970	Valid & Reliable

Source: Processed Primary Data Via SPSS, 2026 (N = 80).

The Cronbach's Alpha coefficients for all variables remained well above the 0.70 threshold, indicating exceptionally high internal consistency and confirming that the research instruments were fully appropriate for subsequent analyses.

Multiple Linear Regression Analysis Results

Multiple linear regression analysis was applied to determine the influence of Occupational Safety (X_1) and Occupational Health (X_2) on Worker Performance (Y). Data processing yielded the following regression equation:

$$\hat{Y} = 0.969 + 0.370X_1 + 0.588X_2$$

This equation indicates that both independent variables carry positive coefficients. The safety coefficient of 0.370 suggests that an incremental improvement in safety corresponds to a 0.370-unit

increase in performance, assuming health remains constant. Similarly, the health coefficient of 0.588 signifies that a rise in health conditions corresponds to a 0.588-unit performance enhancement, assuming safety is held constant.

The coefficient for occupational health exceeds that of safety. This dynamic is reinforced by the standardized beta values—0.383 for safety and 0.602 for health. Thus, within this research model, occupational health exerts a relatively stronger relative contribution to laborer performance compared to occupational safety.

Coefficient of Determination

Testing outcomes yielded an R value of 0.978, an R Square (R^2) of 0.957, and an Adjusted R Square of 0.955.

Table 3. Coefficient of Determination

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.978	0.957	0.955	1.986

Source: Processed Primary Data Via SPSS, 2026.

The R Square value of 0.957 demonstrates that 95.7% of the variance in worker performance can be collectively explained by safety and health variables, while the remaining 4.3% is attributed to external factors excluded from this model.

The Adjusted R Square of 0.955 indicates that even after adjusting for sample size and predictor count, the model retains an extraordinary explanatory capacity of 95.5%. Nonetheless, high R^2 values warrant cautious interpretation given that all variables rely on respondent perceptions gathered

through identical questionnaire instruments. Consequently, authors should cross-verify these regression outputs against Model Summary, ANOVA, and Coefficients tables prior to final journal submission.

The Influence of Occupational Safety on Worker Performance

Partial testing indicated that occupational safety generated a t -statistic of 4.094 with a significance level of $p < 0.001$, confirming that safety exerts a positive and significant impact on terminal worker performance. Consequently, the first research hypothesis is accepted.

This finding highlights that safe operational conditions, procedural compliance, personal protective equipment (PPE) utilization, and hazard control act as foundational pillars supporting operational execution. In container terminals, daily tasks involve heavy machinery mobility, cargo handling, and dynamic environments. Therefore, OSH enforcement extends beyond accident mitigation to secure continuous workflow stability.

These results align with Kuta et al. (2024), who documented that safety and health simultaneously drive employee achievements. Similar conclusions were noted by Palit et al. (2024), indicating that safety practices and standard operating procedures shape performance. Specifically at NPCT1, Juniarto et al. (2021) emphasized that safety integration constitutes a critical component of field operations managed under strict regulatory frameworks.

The Influence of Occupational Health on Worker Performance

Partial test results revealed a t -statistic of 6.433 ($p < 0.001$) for occupational health, proving that health exerts a positive and significant effect on laborer performance. Thus, the second hypothesis is accepted.

This positive correlation confirms that optimal health conditions allow laborers to maintain physical endurance, operational focus, and readiness. Given the physically demanding nature of port labor inside dynamic operational zones, health stewardship serves as a core determinant of sustained productivity.

This outcome echoes Kuta et al. (2024) and corresponds with Wewo et al. (2024), who identified

strong links between health programs and personnel performance at PT Pelindo III Kupang. Furthermore, NPCT1 actively provides routine medical check-ups and occupational health services, including annual screenings and follow-ups (NPCT1, 2025).

Conversely, these findings must be situated alongside contrasting literature where safety parameters do not always manifest identical direct impacts on productivity. Data et al. (2026), for instance, observed in Makassar ports that safety programs lacked partial significance on productivity compared to work discipline, suggesting that organizational traits, job types, and operating systems can moderate these relationships.

Simultaneous Influence of Safety and Health on Worker Performance

Simultaneous testing yielded an F -statistic of 849.088 ($p < 0.001$), far surpassing the critical F table value of 3.12. This confirms that occupational safety and health simultaneously exert a positive and significant influence on worker performance, validating the third hypothesis.

These results verify that safety and health function as complementary pillars. Safety targets risk control and mishap prevention, whereas health preserves physical vitality. Both elements are indispensable in cargo handling, where workers face physical stress alongside hazardous exposure.

Practically, these results imply that elevating performance requires more than chasing operational quotas; it must be backed by consistent SOP enforcement, PPE compliance, hazard monitoring, periodic medical check-ups, and continuous OSH training.

Implications of the Research

The empirical evidence indicates that safety and health correlate positively and significantly with performance at NPCT1. Management must sustain existing programs while rectifying dimensions scoring lower among respondents.

For safety, attention should target indicator $X_{1.4}$ and indicator $X_{1.7}$ through regular procedural audits and enhanced safety communication. For health, indicator $X_{2.5}$ (mean 3.21) warrants priority evaluation via optimized medical access and health tracking, building upon NPCT1's established clinic infrastructure (NPCT1, 2025). Ultimately,

integrating safety and health ensures that operational workflows remain safe, healthy, and sustainable.

CONCLUSION

Based on the results of the data analysis and hypothesis testing conducted in this study, several conclusions can be drawn regarding the impact of occupational safety and health on container terminal worker performance:

1. Occupational safety has a positive and significant partial effect on the performance of loading and unloading workers at PT New Priok Container Terminal One (NPCT1) Tanjung Priok ($t = 4.094$; $p < 0.001$). This confirms that higher compliance with safety procedures and hazard controls directly supports optimal work execution and minimizes operational disruptions. Thus, the first hypothesis is accepted.
2. Occupational health has a positive and significant partial effect on the performance of loading and unloading workers ($t = 6.433$; $p < 0.001$). This demonstrates that maintaining sound physical and physiological health preserves the stamina, concentration, and operational readiness required in high-intensity terminal environments. Thus, the second hypothesis is accepted.
3. Occupational safety and health simultaneously exert a positive and significant effect on worker performance, accounting for an explanatory power (R^2) of 95.7% ($F = 849.088$; $p < 0.001$). This proves that the integration of safety and health programs serves as a primary determinant in boosting maritime operational productivity and efficiency. Thus, the third hypothesis is accepted.

Based on these findings, management is advised to continually intensify Personal Protective Equipment (PPE) compliance oversight, expand routine clinical screenings, and broaden future research parameters to encompass auxiliary aspects such as work discipline or physical working environments.

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