

The Effect of Fatigue Management, Training, Reward Systems, and Information Technology on Occupational Safety Performance

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ABSTRACT

The purpose of this study was to determine the simultaneous and partial effects of the variables Fatigue Management, Training, Reward Systems, and Information Technology on Occupational Safety Performance in the transportation industry at PT. KAI Central Daop Jakarta. This study took place at the PT. KAI Central Daop Jakarta office. This was a quantitative study, with data collection using a questionnaire. The sample consisted of 50 employees in the Occupational Safety and Health (K3) department. Data analysis techniques used were multiple regression, F-test, t-test, and test of determination (R²). Fatigue management influences the Occupational Safety Performance of PT. KAI Central Daop Jakarta employees. Training influences the Occupational Safety Performance of PT. KAI Central Daop Jakarta employees. The Reward System influences the Occupational Safety Performance of PT. KAI Central Daop Jakarta employees. Information Technology influences Occupational Safety Performance of PT. KAI Central Operation Office Jakarta Employees.

Keywords: *Fatigue Management, Training, Reward Systems, Information Technology, Occupational Safety Performance*

INTRODUCTION

Occupational safety and health (K3) is a key foundation in operational management, particularly in the high-activity and high-risk public transportation industry. PT KAI Central Operational Area of Jakarta (Persero), as a state-owned enterprise managing the national railway network, bears a significant responsibility in ensuring the safety of workers and service users. High operational dynamics, including shift systems, service speeds, and productivity pressures, demand a holistic, data-driven approach to safety management. (Rusmila & Elwindra (2022)

One important aspect that is often overlooked in the OHS system is the work fatigue factor. Physical and mental fatigue, especially in workers with long working hours or shift work systems, has been shown to increase the risk of human error, which has the potential to cause work incidents. A study conducted by the International Civil Aviation Organization (ICAO) and the International Petroleum Industry Environmental Conservation Association (IPIECA) stated that the systematic implementation of a Fatigue Risk Management System (FRMS) can identify, evaluate, and control risks due to fatigue through work hour policies, workload monitoring, and self-assessment reporting. (Agustin & Mindiharto, 2025)

In addition to fatigue, occupational safety training plays a crucial role in developing workers' basic competencies. According to the ISO 45001:2018 standard and OSHA guidelines (2023), structured, periodic training tailored to specific job risks

can improve individual awareness, skills, and preparedness for emergencies or potential hazards in the field. However, in practice, training in many organizations remains a formality and has not been evaluated for its effectiveness in changing behavior or reducing incidents (Triasmokoetal, 2020).

On the other hand, reward and incentive systems have a psychological impact on worker motivation in implementing safety procedures. The implementation of safety performance-based incentives, such as bonuses, recognition, and career paths based on OHS competencies, has been shown to increase worker engagement and a positive reporting culture. (Santoso & Lestari, 2021)

Advances in information technology also offer significant opportunities for digitizing OHS systems. The use of cloud-based OHS information systems, mobile incident reporting applications, digital dashboards for leading indicators, and safety e-learning have been shown to improve transparency, traceability, and response to hazards. Many global companies are beginning to integrate digital OHS platforms with other management systems such as ERP and HRIS to ensure the sustainability and effectiveness of real-time risk control. (Siregar & Hidayat, 2022)

However, there is limited research in Indonesia, particularly in the rail transportation sector, that comprehensively examines the relationship between fatigue management, training effectiveness, reward systems, and the use of information technology on occupational safety performance. Therefore, this study is designed to fill this gap with a quantitative approach, in order to obtain evidence-based strategic recommendations (evidence-based practice) for PT KAI Daop Pusat Jakarta in improving the quality of its integrated OHS program. Therefore, this study is important to conduct to provide empirical evidence in the context of rail transportation in Indonesia.

RESEARCH METHODS

This study uses a quantitative descriptive approach. The author chose to use a quantitative descriptive method to determine the magnitude of the influence and significance between the variables of Fatigue Management, Training, Reward System, and Information Technology on Occupational Safety Performance in the Public Transportation Industry of PT KAI Daop Pusat Jakarta. This research was conducted at the company PT KAI Daop Pusat Jakarta. The research time is planned to be carried out for 4 (four) months from September 2025 to November 2025. The population in this study were all employees of PT. KAI Daop Central Jakarta Occupational Safety Department totaling 50 people. The number of samples taken was all operators as many as 50 people or respondents. The sampling technique used in this study was the census technique. The variables used in this study consisted of 2 variables, namely the independent variable (X) and the dependent variable (Y). The independent variables consisted of Fatigue Management (X1), Training (X2), Reward System (X3), and Information Technology (X4) while the dependent variable was Occupational Safety Performance (Y). After the data tabulation was carried out, the data was

processed using multiple linear regression analysis tools with the help of SPSS 27 software. The regression equation model used is as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

Information :

Y	: Occupational Safety Performance Variables
X1	: Fatigue Management Variables
X2	: Training Variables
X3	: Reward System Variable
X4	: Information Technology Variable
a	: constant
b1, b2, b3	: correlation coefficient
e	: error term/nuisance error

RESULTS AND DISCUSSION

Multiple Linear Regression

The multiple linear regression equation is as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

Where :

Y	: Occupational Safety Performance
a	: Constant
b1, b2, b3, b4	: Regression Coefficient
X1	: Fatigue Management
X2	: Training
X3	: Reward System
X4	: Information Technology
e	: Standard error

From these results, the regression equation can be obtained:

$$Y = -0.375 + 0.291X_1 + 0.513X_2 + 0.098X_3 + 0.129X_4.$$

The equation can be explained as follows:

- 1) $a = -0.375$, this means that if the Fatigue Management (X1), Training (X2), Reward System (X3) and Information Technology (X4) factors are considered constant, this will result in employee Occupational Safety Performance. PT. KAI Central Operational Area, Jakarta (Y) decreased by 0.375.
- 2) $b_1 = 0.291$, this means that if the Fatigue Management factor (X1) increases by 1 unit and the Training (X2), Reward System (X3), and Information Technology (X4) variables are considered constant, it will be able to increase employee Occupational Safety Performance. PT. KAI Central Operational Area, Jakarta (Y) is 0.291.
- 3) $b_2 = 0.513$, this means that if the Training factor (X2) increases by 1 unit, and the Fatigue Management (X1), Reward System (X3) and Information Technology (X4) variables are constant, then the employee's Occupational Safety

PerformancePT. KAI Central Operational Area, Jakarta (Y) increased by 0.513.

4) $b_3 = 0.098$, this means that if the Reward System factor (X3) increases by 1 unit, and the Fatigue Management (X1), Training (X2), and Information Technology (X4) variables are constant, then employee Occupational Safety PerformancePT. KAI Central Operational Area, Jakarta(Y) increased by 0.098.

5) $b_4 = 0.129$, this means that if the Information Technology factor (X4) increases by 1 unit, and the Fatigue Management (X1), Training (X2), and Reward System (X3) variables are constant, then employee Occupational Safety Performance will increase.PT. KAI Central Operational Area, Jakarta(Y) increased by 0.154.

For further details, please see the SPSS data processing results table as follows:

Table 1.Summary of Multiple Linear Regression Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-,375	1,054		-,356	,724
Fatigue Management	,291	,055	,399	5,287	,000
Training	,513	,089	,550	5,768	,000
Reward System	,098	,038	,141	2,557	,014
Information Technology	,129	,057	,187	2,261	,029

Source: Data processed in 2026

t-test

The t-test is a hypothesis test to determine whether there is a partial effect between the independent variable and the dependent variable. The results of this analysis are as follows:

1) T-test related to Fatigue Management (X1) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

From the results of the calculation, the results obtained were $t_{count} = 5.287 > t_{table} = 2.014$, so H_0 was rejected, meaning there was an influence between Fatigue Management (X1) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

2) T-test related to Training (X2) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

From the results of the calculation, the results obtained were $t_{count} = 5.768 > t_{table} = 2.014$, so H_0 was rejected, meaning there was an influence between Training (X2) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

3) T-test related to the Reward System (X3) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

From the results of the calculation, the results obtained were $t \text{ count} = 2.557 > t \text{ table} = 2.014$, so H_0 was rejected, meaning there was an influence between Fatigue Management (X1) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

4) T-test related to Information Technology (X4) on the Occupational Safety Performance of Employees of PT. KAI Daop Pusat Jakarta (Y).

From the results of the calculation, the calculated t result for Information Technology (X4) was $= 2.261 > t \text{ table} = 2.014$, so H_0 was rejected, meaning there was an influence between Information Technology (X4) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

From the results above, it can be summarized as follows:

Table 2 t-Test Results

Hypothesis	t-count	t-table	Sig	Standard	Information
H1	5,287	> 2,014	0,000	0.05	H0 Rejected
H2	5,768	> 2,014	0,000	0.05	H0 Rejected
H3	2,557	> 2,014	0.014	0.05	H0 Rejected
H4	2,261	> 2,014	0.02934	0.05	H0 Rejected

Source: Processed data, 2026

So because $t\text{-count} > t\text{-table}$ and the level of significance < 0.05 , then partially there is a positive and significant influence, however if $t\text{-count} < t\text{-table}$ and the level of significance > 0.05 then partially there is no influence of the independent variable on the dependent variable.

Model Feasibility Test

Table 3 Model Feasibility Test

ANOVA						
Model	Sum of Squares	df	Mean Square	F	Sig.	
1 Regression	157,555	4	39,389	75,990	,000b	
Residual	23,325	45	,518			
Total	180,880	49				

Source: Data processed in 2026

From the results of SPSS data processing, the F-count value was obtained at 75.990 with a significance level of 0.000. Because the significance value is $0.000 < 0.05$, then together the independent variables namely Fatigue Management (X1), Training (X2), Reward System (X3) and Information Technology (X4) have an effect on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y).

Analysis of the Coefficient of Determination (R²)

Table 4 Test of Determination Coefficient (R²)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	,933a	,871	,860	,720

Source: SPSS data processing, 2026

By using the SPSS program, it can be obtained for R² of 0.860 or 86%, meaning that together there is an influence between the independent variables, namely Fatigue Management (X1), Training (X2), Reward System (X3) and Information Technology (X4) on the Occupational Safety Performance of PT. KAI Daop Pusat Jakarta Employees (Y) of 86%, while the remaining 14% is influenced by other factors, which were not studied such as organizational culture, incentives, motivation, division of labor, and others.

DISCUSSION

From the results of the data analysis, it can be explained that answering the hypothesis is as follows:

1. The Effect of Fatigue Management on the Occupational Safety Performance of Employees at PT. KAI Daop Pusat Jakarta

The data analysis revealed that fatigue management influences the occupational safety performance of PT. KAI Daop Pusat Jakarta employees. Therefore, the hypothesis is proven correct. This is supported by research by Rusmila & Elwindra (2022) and Agustin & Mindiharto (2025), which states that fatigue management influences the occupational safety performance of PT. KAI Daop Pusat Jakarta employees.

Fatigue management plays a crucial role in improving the occupational safety performance of PT. KAI Daop Pusat Jakarta employees. Poorly managed fatigue can reduce workers' concentration, alertness, and responsiveness, thereby increasing the risk of errors and workplace accidents, particularly in high-risk, 24-hour railway operations. Effective fatigue management, such as healthy work shift arrangements, adequate rest periods, and monitoring of employees' physical and mental conditions, can reduce the potential for human error. Employees become more focused, disciplined in following safety standard operating procedures (SOPs), and able to make quick and accurate decisions. Therefore, fatigue management significantly impacts occupational safety, maintains smooth operations, and ensures safe and high-quality public services within PT. KAI Daop Pusat Jakarta.

2. The Effect of Training on the Occupational Safety Performance of Employees at PT. KAI Daop Pusat Jakarta

From the results of the data analysis, it was found that there was an influence of the Influence of Training on the Occupational Safety Performance of

PT. KAI Daop Pusat Jakarta Employees. So the hypothesis was proven true. Training has a significant influence on Occupational Safety Performance in PT. KAI Daop Pusat Jakarta Employees. This is supported by research by Triasmokoetal (2020), Hakim (2020) and Prabowo (2023)i (2018) that training has an effect on employee performance.

Training has a very significant influence on the occupational safety performance of PT. KAI Daop Pusat Jakarta employees. In a high-risk work environment such as railway transportation, training serves to ensure that each employee has technical competence, procedural understanding, and preparedness to face complex operational conditions. Through occupational safety training, employees gain knowledge regarding standard operating procedures (SOPs), emergency response techniques, the use of safety equipment, and the identification of potential hazards in the work environment. In addition, training improves employees' practical skills in carrying out operational tasks safely and correctly, such as arranging train journeys, maintaining rail lines, using technical equipment, and coordinating between units.

Training also impacts safety attitudes and behavior, as trained employees tend to be more disciplined, alert, and have a higher awareness of implementing a safety culture. With increased competence and awareness, the rate of human error can be reduced and the risk of workplace accidents can be minimized. Ultimately, structured, ongoing, and relevant training tailored to the characteristics of work at PT. KAI Daop Pusat Jakarta is able to improve employee safety performance, maintain smooth operations, and ensure safe train travel for the public.

3. The Influence of the Reward System on the Occupational Safety Performance of Employees at PT. KAI Daop Pusat Jakarta

The data analysis revealed an influence of the reward system on the occupational safety performance of PT KAI Central Operations Office employees in Jakarta. Therefore, the hypothesis was proven correct. This is supported by research by Santoso & Lestari (2021) and Raynaldo (2023), which found that rewards influence employee performance.

The reward system has a significant impact on the safety performance of PT. KAI Daop Pusat Jakarta employees because it can encourage increased motivation, safe behavior, and compliance with safety standards. When employees are rewarded for safe work behavior—whether in the form of incentives, recognition, promotions, or performance appraisal points—they will feel appreciated and motivated to continue maintaining and improving safety practices. A good reward system creates a positive relationship between safety efforts and the direct benefits felt by employees, thus triggering a higher commitment to the safety culture within PT. KAI.

In addition to increasing motivation, a reward system can also strengthen a safety culture by encouraging employees to remind each other, work according to standard operating procedures, and avoid risky behavior.

Employees who are disciplined in implementing safety procedures, arriving on time, reporting potential hazards, and performing their work carefully will be more consistent when these behaviors are formally recognized. Thus, a reward system serves not only as a motivational tool but also as a mechanism for controlling work behavior.

Overall, a reward system implemented fairly, transparently, and directly linked to occupational safety indicators can improve employee compliance, reduce work errors, and decrease accident rates. The impact is improved occupational safety performance of PT KAI Daop Pusat Jakarta employees and the maintenance of smooth and safe railway operations.

4. The Influence of Information Technology on the Occupational Safety Performance of Employees of PT. KAI Daop Pusat Jakarta.

The results of the data analysis showed that information technology influences the occupational safety performance of PT. KAI Daop Pusat Jakarta employees. Therefore, the hypothesis was proven correct. Information technology has a strategic influence on occupational safety performance among PT. KAI Daop Pusat Jakarta employees. This is supported by research by Siregar & Hidayat (2022), Wulandari & Prasetya (2020), which states that information technology influences employee performance.

Information technology has a significant impact on the occupational safety performance of PT. KAI Daop Pusat Jakarta employees because it can improve the speed, precision, and accuracy of operational processes and decision-making. Through the use of information systems such as train tracking, digital communication devices, incident reporting applications, and technology-based sensors, employees can obtain real-time data that helps detect potential hazards more quickly. Information technology enables the rapid and accurate delivery of safety information, allowing employees to promptly respond to emergencies or operational disruptions.

Furthermore, information technology supports increased compliance with safety procedures through automation and digitalization of standard operating procedures (SOPs). For example, the use of inspection applications, safety dashboards, or integrated train control systems helps employees perform their tasks more accurately and reduces the risk of human error. Technology also simplifies the documentation, recording, and analysis of accident and near-miss data, enabling PT. KAI to continuously evaluate and improve occupational safety aspects.

Overall, the use of information technology improves efficiency, strengthens oversight, and accelerates communication within the PT KAI Central Operational Area (Daop Pusat Jakarta) work environment. With the support of a reliable technology system, employee safety performance is optimized, the risk of accidents is minimized, and company operations can run safely and under control.

CONCLUSION AND SUGGESTIONS

The conclusion of this study shows that fatigue management, training, reward systems, and information technology have a significant influence on the occupational safety performance of PT. KAI Daop Pusat Jakarta employees. This indicates that improving occupational safety cannot be done partially, but must be done through an integrated approach between human resource management, competency improvement, motivation, and technology utilization. The implications of this finding emphasize that PT. KAI needs to strengthen fatigue management to reduce the risk of human error, improve the quality and frequency of relevant and applicable training, implement a fair and measurable reward system to encourage compliance with safety SOPs, and optimize the use of information technology as a means of monitoring, reporting, and making decisions related to occupational safety. By strengthening these four aspects, occupational safety performance is expected to improve effectively and sustainably. Therefore, it is recommended that PT. KAI optimize work shift arrangements and provide adequate rest facilities, conduct routine safety training with practical methods such as simulations, implement a reward system that encourages safe behavior, and strengthen the use of digital systems in safety management. In addition, future researchers are advised to add other variables such as safety culture or leadership to broaden and deepen the research analysis.

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