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The Influence of Safety Training and Safety Communication on Safety Performance: The Mediating Role of Safety Culture

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A R T I C L E I N F O

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A B S T R A C T

This study analyzes the effects of Safety Training and Safety Communication on Safety Performance via Safety Culture among 140 operational employees at PT Sagatrade Murni Samarinda, selected via purposive sampling. Data collection was conducted between January and May 2026. Using PLS-SEM via SmartPLS, the results reveal that Safety Training and Safety Communication positively affect Safety Culture, which subsequently influences Safety Performance. Interestingly, Safety Culture fully mediates these relationships, as direct effects on Safety Performance were non-significant. This paper contributes by highlighting Safety Culture as the critical underlying mechanism for enhancing performance. Practically, companies must prioritize cultural integration over standalone training and communication to optimize Occupational Health and Safety (K3) outcomes.

INTRODUCTION

Human resources have shifted from being mere operational costs to becoming the most valuable strategic assets of an organization. In high-risk sectors like the upstream oil and gas equipment manufacturing industry, managing human assets requires an integrated approach to Occupational Health and Safety (K3) to sustain competitive advantage and ensure operational continuity (International Labour Organization (ILO), 2020). Companies in this sector are demanded to balance production efficiency with a strict zero-accident priority. Consequently, understanding the behavioral and cultural drivers of employee safety performance has become crucially essential.

This study is driven by an empirical phenomenon at PT Sagatrade Murni in Samarinda, East Kalimantan, Indonesia, which is a specialized manufacturer of oilfield equipment. As an operational production site employing non-managerial workers directly in high-risk field activities, the company experienced fluctuating safety incidents between 2021 and 2023. Based on internal company records, Lost Time Injuries (LTI) and Lost Workday Cases (LWC) initially stood at 6 cases each in 2021, dropped sharply to zero cases in 2022 following initial safety interventions, but resurfaced to 3 cases each in 2023. This fluctuation reveals a critical operational challenge: why do safety performance achievements deteriorate despite the implementation of safety programs? It indicates that standard safety practices require a deeper underlying mechanism to remain sustainable.

Accordingly, the central research problem addressed in this study is whether Safety Training and Safety Communication alone are sufficient to directly improve Safety Performance or whether their effectiveness depends on the mediating role of Safety Culture. Although Safety Training and Safety Communication have been widely recognized as essential organizational safety practices, previous studies have reported inconsistent findings regarding their effects on Safety Performance. Therefore, clarifying the mediating role of Safety Culture is essential to explain why organizations implementing similar safety interventions may achieve different safety performance outcomes.

Theoretically, safety performance is built upon the pillars of safety training and safety communication (Geller, 2016). Safety training equips workers with technical knowledge, while continuous safety communication reinforces risk awareness in daily routines. However, past empirical studies show conflicting results regarding how these variables translate into actual safety performance. While researchers like Naji et al., (2021, 2022), Atikasari et al., (2022), and Haloui & Li, (2025) found that a strong safety culture significantly optimizes safety performance, a recent study by Jiwantoro, (2024) argued otherwise, stating that safety culture fails to significantly impact employee safety performance. Furthermore, recent literature heavily emphasizes the separate direct impacts of safety training (Syahputri et al., 2025; Tawfeeq et al., 2024) and safety communication (Farhan et al., 2025), leaving the comprehensive mediation mechanism less explored.

This study addresses these empirical and theoretical gaps by positioning Safety Culture (Reason, 2016) as a full mediating variable. This paper provides a

dual contribution to knowledge enrichment. First, it fills the theoretical gap by reconciling the mixed findings in literature, examining whether safety training and communication require a fully internalized safety culture to effectively drive safety performance. Second, it captures a unique niche sample by exploring the dynamics of non-managerial operational workers within an Indonesian oilfield support manufacturing context, which represents a specific geographical and industrial environment that remains underrepresented in international safety management literature. Ultimately, this research offers a framework for organizations to optimize their K3 programs through cultural integration rather than standalone structural training.

THEORETICAL REVIEW

Social Cognitif Theory

Social Cognitive Theory (SCT), developed by Albert Bandura (1986), posits that human behavior is shaped by an interlocking interaction among personal cognitive factors, environmental influences, and the behavior itself. In organizational settings, employee actions are not isolated; they are continuously influenced by workplace surroundings and personal perceptions (Luthans, 2021). Furthermore, Robbins & Judge, (2023) emphasize that individuals learn and modify their behaviors not only through direct experience but also by observing others and interpreting environmental feedback.

In occupational safety research, SCT provides a robust foundation to explain how external environmental interventions, such as Safety Training and Safety Communication, can successfully reshape internal cognitive aspects like Safety Culture, which ultimately drives actual Safety Performance on the shop floor.

Occupational Safety and Health (OSH)

Occupational Safety and Health is fundamentally defined as a comprehensive effort to promote and maintain the highest level of physical, mental, and social well-being across all working environments (International Labour Organization (ILO), 2020). Operationally, this concept involves two distinct yet interrelated dimensions: safety and health. Dessler, (2020) emphasizes that occupational safety focuses on safeguarding employees from physical injuries caused by work-related accidents, whereas occupational health focuses on protecting workers from physical or emotional illnesses triggered by their immediate work environment.

In high-risk manufacturing sectors, the effective implementation of OSH principles goes beyond mere compliance. It establishes the baseline framework that justifies why systematic interventions such as safety training and clear safety communication are essential to shield frontline workers from operational hazards and ultimately optimize their overall safety performance.

Safety Training

Safety training is a structured, continuous organizational intervention designed to develop employees' knowledge, skills, and attitudes regarding

workplace hazards (Goetsch, 2020; Mathis et al., 2017). Rather than being just a routine instruction, it serves as a strategic human resource tool that translates formal safety policies into actionable competencies, ensuring strict compliance with safe operating procedures and regulatory standards (Snell & Morris, 2019). Furthermore, Dessler, (2020) highlights that effective safety training equips frontline workers with specific risk-recognition capabilities and emergency protocols necessary to mitigate hazards and prevent workplace injuries.

In high-risk operational environments, systematic safety training serves as the primary external input that reduces unsafe behaviors. It provides the technical foundation needed to foster a proactive safety culture, which is vital for maintaining an accident-free environment.

Safety Communication

Safety communication is defined as the systematic and multi-directional exchange of occupational safety messages across all hierarchical levels within an organization (Goetsch, 2020; Ivancevich et al., 2018). Rather than being merely a top down mandate, it involves open, two way dialogues, safety coaching, and continuous feedback regarding workplace hazards (Geller, 2016). Furthermore, Robbins & Judge, (2023) emphasize that this communication process is vital for transmitting hazard alerts and safety goals, establishing a shared understanding that eliminates operational ambiguity and actively influences employee compliance.

In high-risk operational environments, effective safety communication serves as an essential organizational mechanism. It transforms passive hazard awareness into active employee engagement, ensuring that critical safety information is consistently internalized to influence daily safe behaviors.

Safety Culture

Safety culture is defined as the shared values, beliefs, assumptions, and norms within an organization that interact with structural systems to produce safe behavioral patterns (Goetsch, 2020). It represents the collective ability of individuals and organizations to deeply understand, respect, and prioritize operational risks, transforming safety from a mere administrative mandate into a collective psychological driving force (Reason, 2016). Furthermore, Cooper, (2019) highlights that these specific cultural aspects directly impact employee attitudes and behaviors regarding the company's continuous health and safety performance.

In a high-risk operational environment, a mature safety culture establishes a proactive atmosphere where safety is treated as a core business value (Friend & Kohn, 2023). It manifests through shared risk awareness, immediate hazard reporting, and an uncompromised collective commitment that consistently prioritizes human protection over production metrics.

Safety Performance

Safety performance is defined as an employee's behavioral execution of safety procedures and active involvement in safety initiatives, serving as the

ultimate metric to determine the success of organizational risk control (Friend & Kohn, 2023). Speck, (2022) conceptualizes this performance through a dual-aspect metric: safety compliance, where workers adhere to mandatory safety regulations, and safety participation, where employees voluntarily engage in activities that support the workplace safety climate. Furthermore, this variable represents the continuous alignment between human action and regulatory standards, which is clearly evidenced by reduced accident rates, proactive near-miss reporting, and the proficient use of personal protective equipment (Hughes & Ferrett, 2021).

In high-risk manufacturing environments, safety performance operates as the final dependent variable. It reflects how effectively external inputs like training and communication, when mediated by an internalized safety culture, successfully manifest as tangible, accident-free behaviors on the shop floor.

Hypothesis Development

Based on Social Cognitive Theory (Bandura, 1986), this study develops a conceptual framework in which Safety Training and Safety Communication are proposed to influence Safety Performance both directly and indirectly through Safety Culture. The proposed relationships are derived from the integration of Social Cognitive Theory and previous empirical findings. Accordingly, the following hypotheses are formulated.

Safety Training and Safety Culture

Safety training acts as a strategic intervention designed to minimize workplace hazards and reduce unsafe acts (Dessler, 2020). Grounded in Social Cognitive Theory (SCT), human behavior results from the triadic interaction between environmental, personal, and behavioral factors (Bandura, 1986). Within this framework, safety training serves as an environmental input that delivers technical knowledge and safety rules to employees. This external input gradually reshapes the workers' personal cognitive perceptions and risk awareness. When these enhanced cognitive insights are practiced daily and reinforced by peers, they merge into collective habits, establishing a robust safety culture on the shop floor.

Empirically, this relationship is supported by Syahputri et al., (2025) demonstrated that structured safety training exerts a positive and significant influence on strengthening safety culture, implying that better training quality leads to a deeper internalization of safety norms. Similarly, Tawfeeq et al., (2024) highlighted that training dimensions act as a primary catalyst for embedding safety commitments across the working environment. Therefore, the following hypothesis is formulated.

H1: Safety Training has a positive effect on Safety Culture.

Safety Communication and Safety Culture

A positive safety culture fundamentally requires an informed and reporting environment where safety risks are transparently shared and near-misses are actively reported (Reason, 1997). Grounded in Social Cognitive

Theory (SCT), organizational communication functions as an environmental factor that shapes personal cognitive perceptions and collective behaviors through continuous feedback and learning (Bandura, 1986). Within this framework, safety communication acts as the primary vehicle for transmitting safety standards, rules, and hazard alerts. Consistent and open dialogues help eliminate ambiguity, allowing employees to internalize organizational expectations. When this information exchange becomes embedded in daily routines, it establishes the shared values and open trust necessary to strengthen a robust safety culture.

This theoretical pathway is strongly supported by recent empirical studies. Kavalela et al., (2024) and Zulkarnain et al., (2025) both demonstrated that safety communication exerts a positive and significant influence on safety culture, highlighting that effective information exchange directly drives cultural maturity. Furthermore, Johannes et al., (2025) reinforced that robust safety communication serves as a critical precursor that enhances safety outcomes by optimizing the internal safety culture. Therefore, the following hypothesis is formulated.

H2: Safety Communication has a positive effect on Safety Culture.

Safety Culture and Safety Performance

A positive safety culture establishes an informed environment supported by reporting, fairness, flexibility, and continuous learning, which guides organizations to recognize risks and correct errors (Reason, 1997). When safety becomes an internalized shared value, it directly drives employee safety performance. According to Griffin & Neal, (2000), this performance manifests through two behavioral dimensions: safety compliance (adherence to mandatory procedures) and safety participation (voluntary engagement in supporting the workplace safety climate). Grounded in Social Cognitive Theory (SCT), safety culture functions as the psychological and social environment that provides the norms, values, and reinforcements regarding workplace safety (Bandura, 1986). A strong safety culture shapes employees' personal cognitive perceptions, motivating them to maintain strict compliance and actively participate in safety initiatives, which ultimately optimizes overall safety performance.

Empirically, the positive and significant influence of safety culture on safety performance has been widely validated across various high-risk industries (Abeje & Luo, 2023; Atikasari et al., 2022; Haloui & Li, 2025; Naji et al., 2021, 2022). However, a research gap exists as Jiwantoro, (2024) reported an inconsistent finding, demonstrating a negative and non-significant relationship between these variables. This empirical ambiguity underscores the necessity of re-examining the pathway in this study. Therefore, the following hypothesis is formulated.

H3: Safety Culture has a positive effect on Safety Performance.

Safety Training and Safety Performance

Safety training is a planned organizational effort designed to develop comprehensive task competencies, safety knowledge, and risk-reduction skills

among employees (Noe, 2020). Through continuous training, frontline workers become fully equipped to identify operational hazards and execute specific emergency protocols Valentine et al., (2020). Grounded in Social Cognitive Theory (SCT), safety training establishes a controlled learning environment that builds individual capabilities and self-efficacy (Bandura, 1986). These enhanced internal perceptions directly influence outward behavior, empowering workers to strictly maintain safety compliance and participate in securing an accident-free environment.

Empirically, Syahputri et al., (2025) demonstrated that structured safety training exerts a positive and significant influence on safety performance. However, an empirical research gap exists as Tawfeeq et al., (2024) found that safety training does not significantly impact safety performance, indicating that training participation does not automatically translate into safe actions without consistent workplace enforcement. This inconsistency highlights the need for further investigation. Therefore, the following hypothesis is formulated.
H4: Safety Training has a positive effect on Safety Performance.

Safety Communication and Safety Culture / Performance

Consistent, open, and multi-directional safety communication by management is a foundational pillar that actively drives operational safety performance (Vinodkumar & Bhasi, 2010). Regular communication channels such as shift-based toolbox meetings and transparent hazard reporting sharpen employees' continuous risk recognition, directly enhancing both mandatory safety compliance and voluntary safety participation. In the SCT framework, active safety communication serves as a powerful environmental stimulus (Bandura, 1986). It delivers consistent safety messages that eliminate ambiguity, encouraging employees to internalize safe operational habits.

This relationship is supported by Mashi et al., (2018) and Jiwantoro, (2024) confirmed that safety communication positively and significantly influences safety performance. Conversely, Chen et al., (2018) reported a negative and significant effect. This empirical ambiguity reinforces the importance of re-evaluating this pathway. Therefore, the following hypothesis is formulated.
H5: Safety Communication has a positive effect on Safety Performance.

The Mediating Role of Safety Culture between Training and Performance

Safety training provides the baseline framework for risk mitigation by establishing necessary rules and procedures (Valentine et al., 2020). However, according to Social Cognitive Theory, external environmental interventions like training require an internal psychological anchor to sustain safe long term behavior (Bandura, 1986). In this research model, safety culture acts as that mediating psychological environment. Ongoing training demonstrates an organizational commitment to safety, which gradually shifts individual awareness into shared collective values Santi et al., (2020). Once these safe habits are fully embedded into the organizational safety culture, they automatically manifest as sustainable safety compliance and active participation on the shop floor (Naji et al., 2021).

Empirically, Syahputri et al., (2025) confirmed that safety culture significantly mediates the relationship between safety training and employee safety performance, proving that training maximizes behavioral outcomes primarily when it matures into an organizational culture. Therefore, the following hypothesis is formulated.
H6: Safety Training has a positive effect on Safety Performance through the mediation of Safety Culture.

The Mediating Role of Safety Culture between Communication and Performance

Developing a mature safety culture requires open, two-way safety communication and consultation across all hierarchical levels (Hughes & Ferrett, 2021). This continuous dialogue fosters an informed and proactive reporting environment where near-misses are transparently analyzed, matching the core dimensions of a positive safety culture (Reason, 1997). Under the SCT perspective, persistent communication acts as the environmental input that shapes the shared norms and cognitive values of the workforce. This established culture then becomes the primary force driving individual safety outcomes Naji et al., (2021).

While Naji et al., (2022) identified a strong interconnection among these variables, they positioned communication as a mediator for culture, creating a directional debate in existing literature. Testing safety culture as a mediator for safety communication helps clarify this theoretical pathway. Therefore, the following hypothesis is formulated.
H7: Safety Communication has a positive effect on Safety Performance through the mediation of Safety Culture.

METHODOLOGY

Research Design

This study employs a quantitative approach with a causal-associative design to evaluate the structural relationships among safety training, safety communication, safety culture, and safety performance. Operating within a hypothetico-deductive framework, existing occupational health and safety theories were utilized to develop the research hypotheses, which are subsequently tested empirically (Cresswell & Creswell, 2018). Primary data collection was executed through a survey method utilizing a cross-sectional approach, where structured questionnaires were administered within a single, specific time frame (Sekaran & Bougie, 2020)

Population and Sample

The target population for this study comprises 200 active employees at an oil and gas equipment manufacturing and fabrication firm in Samarinda, Indonesia. A non-probability purposive sampling technique was applied to select respondents who possess specific information relevant to the research objectives (Sekaran & Bougie, 2016). To ensure data validity, respondents were filtered based on specific inclusion criteria: (1) active employment status to capture real-time workplace dynamics; (2) assignment to operational and

technical support departments within high-to-medium risk zones (Production, Quality Control, HSE, and Warehouse/Logistics) where safety performance is critical; (3) productive age bracket (20 to 45 years) to ensure logical situational awareness; and (4) a minimum tenure of one year, guaranteeing sufficient exposure to organizational safety training, communication, and culture.

To determine the minimum sample size suitable for PLS-SEM analysis, this study adopted the "10-times rule" proposed by (Hair et al., 2022). Based on the 16 parameters estimated within the structural model, a minimum of 160 respondents was established as the final analytical sample for statistical testing.

Data Analysis

Data analysis was conducted using Partial Least Squares–Structural Equation Modeling (PLS-SEM) via SmartPLS3 software. The assessment followed a two-stage analytical procedure: evaluation of the measurement model (outer model) and the structural model (inner model) (Hair et al., 2022). The measurement model was evaluated using convergent validity (outer loadings and Average Variance Extracted [AVE]), discriminant validity via the Heterotrait-Monotrait (HTMT) ratio, and internal consistency reliability using Composite Reliability (CR).

Subsequently, the structural model was assessed by analyzing collinearity (Variance Inflation Factor [VIF]), explanatory power (R^2), effect size (f^2), and predictive relevance (Q^2). Hypotheses and mediation pathways—specifically examining the role of Safety Culture in mediating the effects of Safety Training and Safety Communication on Safety Performance were tested using the bootstrapping procedure, with significance determined at a threshold of $p < 0.05$.

RESULTS

Respondent Characteristics

The demographic characteristics of the 160 respondents were analyzed based on gender, age, educational level, tenure, and department/work unit. These characteristics provide important organizational context for interpreting the study findings. The distribution of respondents is presented in Table 1.

Table 1. Demographic Characteristics of Respondents ($N = 160$)

Characteristics	**Category**	**Frequency**	**Percentage (%)**
Gender	Male	148	92.50%
	Female	12	7.50%
Age (Years)	20–24	24	15.00%
	25–29	57	35.63%
	30–34	39	24.38%
	35–39	22	13.75%
	Over 40	18	11.25%
Education Level	Senior High School / Vocational High School	115	71.88%
	Diploma III	27	16.88%

Characteristics	Category	Frequency	Percentage (%)
	Bachelor's Degree	18	11.25%
Tenure (Years)	1-3	58	36.25%
	4–6	62	38.75%
	7-9	22	13.75%
	Over 10	18	11.25%
Department / Work Unit	Warehouse, Logistics & Shipping Department	23	14.38%
	HSE (Health, Safety & Environment) Department	13	8.13%
	Production Department (Cementing, CNC, Assembly/SCP)	99	61.88%
	Quality Control (QC) Department	25	15.63%

Source: SPSS Output.

Table 1 indicates that the sample comprises 148 male employees (92.50%) and 12 female employees (7.50%), establishing a male-dominated operational workforce. The age distribution is heavily concentrated between 25 and 29 years old (35.63%), followed by the 30–34 cohort (24.38%), which underscores a highly productive demographic. Most respondents completed vocational or senior high school education (71.88%), with the remainder holding Diploma III certificates (16.88%) and bachelor's degrees (11.25%). In terms of tenure, the 4–6 years category constitutes the largest group (38.75%), closely followed by workers with 1–3 years of experience (36.25%). Departmental mapping reveals that the Production unit (Cementing, CNC, Assembly/SCP) accounts for the largest share (61.88%), followed by Quality Control (15.63%), Warehouse, Logistics & Shipping (14.38%), and HSE (8.13%).

This demographic profile confirms that the respondents are frontline personnel directly exposed to daily manufacturing risks. Their strong operational awareness is consistently supported by the company's safety infrastructure, which includes mandatory onboarding, daily pre-shift briefings, and annual refresher training conducted 1 to 2 times. Because these workers are highly experienced and familiar with institutional safety protocols, the collected dataset provides a reliable and realistic basis for analyzing Safety Training, Safety Communication, Safety Culture, and Safety Performance.

Descriptive Analysis

The descriptive analysis shows that Safety Training (X_1) obtained an average score of 4.26, which falls into the high category. This indicates that the company's safety training programs are running optimally, highlighted by highly relevant materials that match the physical risks on the fabrication floor. Safety Communication (X_2) obtained an average score of 4.19, also in the high category, suggesting that safety information is effectively shared, particularly through daily verbal briefings before shifts start. Meanwhile, Safety Culture (Y_1)

achieved an average score of 4.21, falling into the high category. This result shows that a safety mind-set is deeply embedded among the workforce, as reflected in their agility to adapt to external oil and gas regulations and their open evaluation of near-miss incidents. Lastly, Safety Performance (Y_2) obtained an average score of 4.17, which falls into the high category, demonstrating that field employees consistently adhere to standard operating procedures (SOPs) and actively maintain safety compliance during daily operations.

Measurement Model Evaluation (Outer Model)

The measurement model was evaluated to ensure the validity and reliability of the research constructs based on convergent validity and internal consistency criteria. Empirical results from the SmartPLS analysis show that all indicator outer loadings exceed the acceptable exploratory threshold of 0.60, with the highest loading recorded by item X2.2 (Safety Communication) at 0.910, while items X1.2 and Y1.4 yield the lowest at 0.693. To establish convergent validity, the Average Variance Extracted (AVE) for all latent variables surpasses the mandatory 0.50 benchmark, where Safety Communication scores the highest at 0.767, followed by Safety Performance (Y2 = 0.680), Safety Training (X1 = 0.597), and Safety Culture (Y1 = 0.532). Furthermore, all constructs demonstrate robust internal consistency reliability, as evidenced by Composite Reliability (CR) values that comfortably exceed the 0.70 threshold, specifically Safety Communication at 0.908, Safety Performance at 0.895, Safety Training at 0.854, and Safety Culture at 0.849. Because all latent variables completely satisfy both the convergent validity and construct reliability parameters, the overall measurement model is confirmed to be highly reliable and structurally sound for subsequent hypothesis testing. Additionally, discriminant validity was rigorously evaluated using the Heterotrait-Monotrait Ratio (HTMT) criteria. To ensure that each latent construct is empirically unique and captures phenomena not represented by other variables, all HTMT correlation values must strictly remain below the conservative threshold of 0.85. The SmartPLS output indicates that the highest HTMT ratio occurs in the correlation between Safety Culture (Y1) and Safety Performance (Y2), while the lowest ratio is observed between Safety Training (X1) and Safety Communication (X2). Since every single cross-construct ratio falls comfortably below the 0.85 benchmark, discriminant validity is fully established, verifying that all four variables are distinct constructs ready for structural model analysis.

Structural Model Evaluation (Inner Model)

The structural model was rigorously evaluated using collinearity statistics, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2) parameters. The internal Variance Inflation Factor (Inner VIF) values comfortably remain below the critical threshold of 5.00 specifically ranging from 1.500 to 3.234 confirming that the structural pathways are entirely free from multicollinearity issues. The coefficient of determination yields an R^2 value of 0.691 ($R^2_{\text{adj}} = 0.687$) for Safety Culture (Y_1), indicating that Safety Training (X_1) and Safety Communication (X_2) explain 69.1% of its variance.

Meanwhile, Safety Performance (Y_2) records an R^2 value of 0.522 ($R^2_{\text{adj}} = 0.513$), meaning that 52.2% of its variance is accounted for by the combined effects of X_1, X_2, and Y_1, establishing a moderate and satisfactory explanatory power for both endogenous constructs.

The individual contributions of the exogenous variables are captured through the effect size (f^2) analysis. Safety Communication exhibits a substantial direct impact on Safety Culture ($f^2 = 0.529$), closely followed by the strong effect of Safety Training on Safety Culture ($f^2 = 0.417$). Conversely, Safety Culture exerts a moderate effect on Safety Performance ($f^2 = 0.296$), whereas the direct paths from Safety Communication ($f^2 = 0.013$) and Safety Training ($f^2 = 0.005$) to Safety Performance fall below the 0.020 benchmark and are considered negligible. Lastly, the blindfolding procedure reveals Q^2 values of 0.349 for Safety Culture and 0.333 for Safety Performance. Since both coefficients are substantially greater than zero, the structural framework exhibits high predictive relevance and structural reliability, proving that the model is robust and fully prepared for subsequent hypothesis testing.

Hypothesis Testing

Hypothesis testing was conducted using the bootstrapping procedure in SmartPLS to examine the statistical significance of the direct relationships among the constructs. This method allows for the simultaneous estimation of path coefficients, t -values, and p -values, providing a robust assessment of the structural model. A direct relationship is considered statistically significant if the p-value is less than 0.05 ($p < 0.05$) or the t-statistic exceeds 1.96. The empirical results of the direct effect testing are summarized in Table 2.

Table 2. Result of Direct Effect

Hypothesis	Direct Relationship	Path Coefficient	t-value	p-value	Decision
H1	Safety Communication (X_2) → Safety Culture (Y_1)	0.496	11.872	0.000	Supported
H2	Safety Communication (X_2) → Safety Performance (Y_2)	0.122	1.505	0.133	Not Supported
H3	J Safety Culture (Y_1) → Safety Performance (Y_2)	0.677	7.725	0.000	Supported
H4	Safety Training (X_1) → Safety Culture (Y_1)	0.440	10.724	0.000	Supported
H5	Safety Training (X_1) → Safety Performance (Y_2)	-0.070	0.754	0.451	Not Supported

Source: SmartPLS Output.

The empirical results in Table 2 reveal that three out of the five hypothesized direct relationships are positive and statistically significant, while

the remaining two paths fail to meet the significance criteria. Safety Communication significantly and positively affects Safety Culture ($\beta = 0.496, t = 11.872, p < 0.001$), indicating that enhanced communication channels directly foster a stronger corporate safety culture. Similarly, Safety Training exerts a strong positive impact on Safety Culture ($\beta = 0.440, t = 10.724, p < 0.001$), verifying that robust safety education programs significantly solidify internal safety mind-sets. Notably, Safety Culture demonstrates the most powerful direct effect in the entire structural model toward Safety Performance ($\beta = 0.677, t = 7.725, p < 0.001$), identifying it as the primary driver for high workplace safety behavior. Conversely, the direct paths from both Safety Communication ($\beta = 0.122, t = 1.505, p = 0.133$) and Safety Training ($\beta = -0.070, t = 0.754, p = 0.451$) to Safety Performance are statistically insignificant, demonstrating that neither variable can directly improve safety performance without an intervening mechanism.

Mediation Analysis

In addition to the direct pathways, a mediation analysis was performed to evaluate the indirect effects of Safety Communication (X_2) and Safety Training (X_1) on Safety Performance (Y_2) through Safety Culture (Y_1). The significance of these mediating mechanisms was assessed via the specific indirect effects procedure in SmartPLS using bootstrapping. In alignment with PLS-SEM guidelines, a mediating relationship is determined to be statistically significant if the p-value falls below 0.05 ($p < 0.05$) and the t-statistic exceeds 1.96. The empirical results of the specific indirect effect testing are presented in Table 3.

Table 3. Specific Indirect Effects

Hypothesis	**Indirect Relationship**	**Path Coefficient**	**t-value**	**p-value**	**Decision**
H6	Safety Communication (X_2) → Safety Culture (Y_1) → Safety Performance (Y_2)	0.335	6.461	0.000	Full Mediation
H7	Safety Training (X_1) → Safety Culture (Y_1) → Safety Performance (Y_2)	0.298	6.150	0.000	Full Mediation

Source: SmartPLS Output.

The specific indirect effect results detailed in Table 3 reveal that Safety Culture (Y_1) serves as an essential, highly significant intervening mechanism within the structural model. Specifically, Safety Culture fully mediates the relationship between Safety Communication and Safety Performance (H6: $\beta = 0.335, t = 6.461, p < 0.001$). Because the direct link between Safety Communication and Safety Performance is statistically non-significant, this establishes a full mediation effect, meaning that communication initiatives must successfully materialize into an embedded safety culture before they can yield actual behavioral safety performance.

Similarly, Safety Culture exerts a full mediation effect on the relationship between Safety Training and Safety Performance (H7: $\beta = 0.298, t = 6.150, p < 0.001$). Given that the direct effect of Safety Training on Safety Performance is also non-significant, this confirms that formal safety training programs cannot directly translate into compliance without first reshaping the organizational safety culture. Collectively, these findings underscore that driving tangible safety performance improvements among employees at PT Sagatrade Murni Samarinda relies entirely on establishing a robust internal safety culture as the primary structural bridge.

Model Fit Evaluation

The structural model fit was evaluated using the Standardized Root Mean Square Residual (SRMR). The SRMR measures the average difference between the observed correlation matrix and the model-implied correlation matrix. In PLS-SEM analysis, an SRMR value below 0.08 indicates a perfect fit, while values up to 0.10 or below 0.11 are considered acceptable for exploratory behavioral models. The results are presented in Table 4.

Table 4. Model Fit Results (SRMR)

	Saturated Model	**Estimated Model**
SRMR	0.106	0106

Source: SmartPLS Output.

The data in Table 4 shows that both the saturated model and the estimated model record an SRMR value of 0.106. Although this value is higher than the strict 0.08 threshold, it remains within the acceptable 0.11 limit for exploratory studies on organizational safety. This indicates that the residual error is low, confirming that the constructed structural model has an acceptable fit to complement the inner model analysis.

DISCUSSION

The Impact of Safety Training on Safety Culture

The empirical findings demonstrate that Safety Training (X_1) exerts a significant positive impact on Safety Culture (Y_1). This relationship highlights that systematic occupational health and safety training effectively equips employees with essential safety knowledge, establishing a solid baseline for rule compliance. Statistically, item $X_{1.3}$ (interactive and responsive instructor delivery) serves as the primary driver (loading = 0.843), underscored by high descriptive satisfaction for item $X_{1.1}$ regarding risk-aligned materials (mean = 4.37). This dynamic is highly supported by the demographic profile of the workforce, which is predominantly comprised of adaptive, young productive-age professionals (25–29 years old, 35.63%) with mid-level technical experience (4–6 years, 38.75%) working within high-risk production units (61.88%). Viewed through Social Cognitive Theory, safety training acts as an environmental factor providing structural observational learning and guided practices. This structural learning successfully transforms individual capabilities into a shared organizational safety mind-set, aligning with

the industrial baselines established by Naji et al. (2021, 2022) and Atikasari et al. (2022).

The Impact of Safety Communication on Safety Culture

Safety Communication (X_2) displays a critical positive and statistically significant influence on Safety Culture (Y_1). Clear, bilateral information exchanges regarding operational risks noticeably increase baseline safety awareness. Item $X_{2.2}$, reflecting management's responsiveness to employee hazards and safety feedback, stands out as the most dominant indicator (loading = 0.910), complemented by routine, direct verbal pre-job briefings ($X_{2.3} = 4.21$). The productive age and mid-level workspace tenure of the respondents facilitate rapid, accurate absorption and consistent field replication of these critical safety instructions. Under Social Cognitive Theory, safety communication functions as an environmental catalyst through which personnel continuously witness, process, and mirror protective behavioral norms. This ongoing feedback loop accelerates the deep internalization of corporate safety guidelines, corroborating the contemporary empirical frameworks of Haloui & Li (2025) and Naji et al. (2022).

The Impact of Safety Culture on Safety Performance

The analysis shows that Safety Culture (Y_1) positively and significantly enhances Safety Performance (Y_2), proving that a grounded safety ecosystem is the fundamental driver of secure field operations. Item $Y_{1.4}$ yields the highest loading (0.871), proving that the capacity of the workforce to adapt to updated occupational safety protocols directly shapes the overall strength of the safety culture. The concentration of young, highly active workers in the production department creates an agile organizational environment that readily operationalizes active near-miss tracking ($Y_{1.5}$). Social Cognitive Theory defines safety culture as an essential personal factor that operationalizes external environmental variables (training and communication) into tangible behavioral actions. This structured cognitive transition triggers proactive danger mitigation and steady compliance, supporting the core safety models developed by Naji et al. (2021, 2022) and Haloui & Li (2025).

The Direct Impact of Safety Training and Safety Communication on Safety Performance

Interestingly, both Safety Training ($X_1 \rightarrow Y_2: \beta = -0.070, p = 0.451$) and Safety Communication ($X_2 \rightarrow Y_2: \beta = 0.122, p = 0.133$) possess statistically non-significant direct effects on Safety Performance. These results explicitly reveal that formal safety education courses and open communication lines are insufficient on their own to automatically yield safer field performance. Although the structural indicators confirm excellent instructional quality ($X_{1.3}$) and an inclusive feedback mechanism ($X_{2.2}$), these environmental inputs cannot bypass structural intermediate processes. Within the Social Cognitive Theory matrix, raw learning components and regulatory information must be systematically processed through an intervening baseline before triggering permanent behavioral

adaptations. These direct-path outcomes differ from Haloui & Li (2025), yet strongly reinforce Jiwantoro (2024), demonstrating that infrastructure and verbal mandates fail to optimize safety compliance unless anchored by a functioning mediation layer.

The Mediating Role of Safety Culture

The specific indirect effect evaluations confirm that Safety Culture (Y_1) functions as a crucial structural bridge, exerting a statistically significant full mediation effect on both the Safety Training pathway ($X_1 \rightarrow Y_1 \rightarrow Y_2: \beta = 0.298, t = 6.150, p < 0.001$) and the Safety Communication pathway ($X_2 \rightarrow Y_1 \rightarrow Y_2: \beta = 0.335, t = 6.461, p < 0.001$). Because both corresponding direct pathways to Safety Performance are entirely non-significant, these findings prove that a full mediation framework exists. Consequently, technical training interventions ($X_{1.3}$) and managerial communication channels ($X_{2.2}$) can only improve operational safety outcomes once they successfully reshape employee behavior and adaptability ($Y_{1.4}$). From a Social Cognitive perspective, Safety Culture serves as the primary engine for internalizing external protective parameters. This total mediation model underscores that optimizing field-level safety compliance at PT Sagatrade Murni Samarinda relies heavily on leveraging a strong corporate safety culture to convert raw training data and communication flows into actual safe behavioral practices, confirming the established empirical paradigms of Naji et al. (2021, 2022) and Haloui & Li (2025).

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that Safety Culture serves as the key organizational mechanism through which Safety Training and Safety Communication contribute to improved Safety Performance at PT Sagatrade Murni Samarinda. Rather than demonstrating that safety interventions alone are sufficient to enhance employee safety behavior, the results indicate that their effectiveness depends on the successful internalization of shared safety values and norms within the organization. This implies that sustainable improvements in workplace safety are achieved not merely through the implementation of safety programs, but through the development of a strong organizational Safety Culture that transforms safety knowledge and communication into consistent safe behaviors. Therefore, this study enriches the occupational safety literature by demonstrating the critical mediating role of Safety Culture in linking organizational safety practices with employee Safety Performance. From a practical perspective, organizations should prioritize the development of Safety Culture alongside formal safety training and communication programs to achieve sustainable workplace safety outcomes.

Recommendations

Based on the empirical findings, several strategic recommendations are proposed for the management of PT Sagatrade Murni Samarinda to enhance workplace safety outcomes. First, management should continuously optimize the structural quality of its safety interventions by utilizing highly interactive training methods, deploying responsive and field-competent instructors, and continuously

aligning educational materials with localized daily operational risks. Second, safety communication protocols must be systematically reinforced through structured feedback loops, routing direct verbal safety briefings before shifts, and establishing transparent hazard and near-miss reporting mechanisms to build corporate-wide psychological safety. Ultimately, since the structural model proves that training and communication rely entirely on a cultural catalyst, management must focus heavily on integrating these programs into a robust safety culture. This integration can be successfully achieved by strengthening direct field-level supervisory controls to ensure strict SOP compliance, establishing a mutual safety-monitoring environment among peers, and instituting an evaluation-driven reward system to incentivize consistent proactive safe behaviors.

FURTHER STUDY

For future academic research, several directions are recommended to broaden the scope of occupational safety literature. Future studies should explore additional critical organizational variables that could directly optimize safety performance, such as safety leadership styles, employee intrinsic motivation, or perceived organizational support. Furthermore, executing longitudinal research designs is highly encouraged to track the long-term operational shifts in behavior following targeted improvements in training and communication systems. Lastly, expanding the geographical reach and expanding the sample size to encompass multiple industrial sites or diverse high-risk manufacturing sectors would significantly enhance the generalizability of the structural framework, allowing for a broader comparative analysis of occupational health and safety dynamics.

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