Research Horizon

ISSN: 2808-0696 (p), 2807-9531 (e)

Research Horizon
Volume: 06
Issue: 01
Year: 2026
Page: 111-126

Citation:
Gultom, D. C. U., & Erislan. (2026). Integrated effects of safety culture dimensions on occupational health and safety performance: Insights from Balikpapan refinery contractors. *Research Horizon*, *6*(1), 111–126.

Article History:
Received: January 20, 2026
Revised: February 12, 2026
Accepted: February 23, 2026
Online since: February 28, 2026

Integrated Effects of Safety Culture Dimensions on Occupational Health and Safety Performance: Insights from Balikpapan Refinery Contractors

Dessy Chaterina Ullyma Gultom[1*], Erislan[1]

[1] Universitas Sahid Jakarta, Jakarta, Indonesia

[*] *Corresponding author: Dessy Chaterina Ullyma Gultom (dessy.gultom@pertamina.com)*

Abstract

The oil and gas sector faces high accident risks, making safety culture vital, especially for contractors. In Balikpapan's refineries, gaps in perception, behavior, and support systems lead to inconsistent safety practices and lingering hazards. This study aims to examine the influence of safety culture dimensions, psychological, behavioral, and situational, on occupational health and safety performance among contractor workers in this high-risk setting. A quantitative approach was adopted using a cross-sectional survey of 382 contractor workers. Data were collected through a structured questionnaire with Likert-scale items and analyzed using partial least squares structural equation modeling. The measurement model confirmed validity and reliability after minor item refinement, while the structural model assessed direct and combined effects of the dimensions. Results show that all three dimensions positively and significantly influence occupational health and safety performance, with the situational dimension exerting the strongest effect, followed by behavioral and psychological dimensions. Together, the dimensions explained nearly seventy percent of the variance in performance. The study concludes that integrated development of organizational systems, consistent safe behaviors, and supportive worker perceptions is essential for enhancing safety outcomes in contractor-heavy environments. Strengthening situational factors offers the greatest potential for reducing risks and supporting zero-accident goals in the industry.

Keywords

Behavioral, Contractor Workers, Occupational Health and Safety, Oil and Gas Industry, Psychological, Safety Culture.

1. Introduction

The oil and gas industry faces high risks related to Occupational Health and Safety (OHS), making safety culture a key factor in reducing accidents and improving performance. Global reports show that over 2.78 million deaths occur each year from work-related diseases and accidents, with around 374 million non-fatal injuries worldwide (ILO, 2020; Indrayani & Kusumojanto, 2020; Tamon et al., 2025). In the energy sector, fatality rates reach 0.84 per million work hours, higher than in other industries (IOGP, 2021). These numbers highlight the need for strong safety measures in high-risk environments like oil and gas operations. In Indonesia, regulations such as the Ministry of Energy and Mineral Resources Number 38 of 2017 require companies to implement an integrated Oil and Gas Safety Management System to protect workers (Kontogiannis et al., 2017; Timbang et al., 2023). However, challenges remain in fully applying these rules, as some firms struggle with effective execution (Karya, 2021). Beyond technical rules, a mature safety culture that combines organizational systems, worker behavior, and human factors is essential for success (Setiawan & Astutik, 2022; ESDM, 2024; Kumar et al., 2024). This culture helps prevent incidents by fostering awareness and commitment at all levels.

In Balikpapan's oil and gas industry, which is expanding through the Refinery Development Master Plan (RDMP), thousands of contractor workers handle high-risk tasks daily. This site uses advanced technology for large-scale production, where accidents can harm people, the environment, assets, and company reputation (PT KPB, 2025). Despite safety programs, issues persist in psychological, behavioral, and situational dimensions of safety culture (Bautista-Bernal et al., 2024). For example, some workers show low risk perception and view safety procedures as mere formalities. Behavioral problems include inconsistent use of Personal Protective Equipment (PPE), reflecting poor internalization of safety values. Situational weaknesses appear in inadequate reporting systems and inconsistent follow-up on inspections or audits (Pagoray, 2022). Safety data up to August 2025 records six near-miss cases, indicating ongoing risks driven by human factors. Inspections reveal 87,582 findings, with major violations in categories like "Others" (28%), "Line of Fire" (26%), and "Tools & Equipment" (21%), and 43.9% of HSSE issues unresolved, especially in unsafe conditions, cranes and lifting, and working at height. Low participation in OHS programs like On Duty Management and Behavior-Based Safety (*Pengamatan dan Komunikasi Keselamatan*/PEKA) shows uneven safety culture among contractors, with some achieving zero involvement.

Previous studies confirm the link between safety culture and OHS performance across industries. Naji et al. (2021) and Pradja and Wibowo (2022) found that strong safety culture, including management commitment, worker involvement, and work environment, positively affects safety performance by reducing psychosocial risks as a mediator. Abeje and Luo (2023) showed that safety culture and climate improve safety performance through worker engagement, strengthening safe behaviors. Nugroho et al. (2023) and Bautista et al. (2024) demonstrated that enhancing safety culture not only boosts OHS performance but also improves financial outcomes in European firms. These findings support that psychological, behavioral, and situational dimensions are key determinants for better OHS in high-risk sectors like oil and gas. However, a strong safety culture requires balance among human, technical, and system pillars, with safety culture as the foundation (Thomas, 2012; Jasiulewicz-Kaczmarek, 2022). In oil and gas, this integration ensures worker safety, public protection, environmental care, and facility integrity (ESDM, 2024).

Despite these insights, research gaps exist in examining the combined effects of psychological, behavioral, and situational dimensions of safety culture on OHS performance, especially among contractor workers in the oil and gas sector.

According to Aula et al. (2021), most prior studies focus more on leadership roles or general safety climate without breaking down the specific influences of these three dimensions. This leaves a need for deeper analysis in contexts like Balikpapan, where large projects involve diverse contractors with varying work cultures. Gaps in theory versus practice also show that while safety culture should reduce accidents (Cooper, 2000), real-world inconsistencies in behavior, risk communication, and HSSE programs persist. Contractors face higher incident rates than permanent staff, yet they must follow the main company's OHS standards under ESDM regulations. This study addresses these gaps by focusing on contractors, unlike earlier works like Naji et al. (2021), Abeje and Luo (2023), and Bautista et al. (2024), which view safety culture more broadly without a dimensional breakdown.

The purpose of this study is to analyze the influence of safety culture dimensions psychological, behavioral, and situational on OHS performance among contractor workers in Balikpapan's oil and gas industry. Specifically, it examines the individual effects of each dimension and their combined impact. By doing so, the research aims to provide empirical evidence for improving safety strategies, reducing accidents, and supporting zero-accident goals. Findings can guide managers in creating targeted interventions for better OHS integration. This approach offers practical benefits for the industry and contributes to academic knowledge on safety in high-risk settings.

2. Literature Review and Hypothesis Development

2.1. The Effect of Psychological Dimension on OHS Performance

The psychological dimension covers workers' attitudes, perceptions, values, and beliefs about safety. It focuses on how individuals view safety as a shared responsibility rather than just a rule to follow. According to Cooper (2000), this dimension forms the base for safe behavior because positive perceptions increase motivation to comply with procedures. When workers trust management's commitment and feel safe to speak up, their risk awareness grows stronger. Guldenmund (2000) notes that shared perceptions shape group norms and influence daily decisions on hazards. In practice, low psychological buy-in leads to viewing safety as formal paperwork, while high buy-in builds genuine care for well-being. Reason (2016) highlights that informed and just cultures support open perceptions that encourage learning from events.

This dimension links to OHS performance by affecting how workers engage with safety practices (Nelson & Zega, 2021). Positive psychological factors lead to higher participation in reporting, training, and hazard identification. Naji et al. (2021) found that good safety perceptions reduce psychosocial hazards and mediate better safety outcomes through worker involvement. Abeje and Luo (2023) showed that positive attitudes strengthen engagement, which in turn boosts safe actions and performance. In oil and gas, where risks are high, workers' trust in leadership and belief in system effectiveness directly impact compliance and incident prevention. Weak perceptions can create gaps between policy and practice, leading to inconsistent results.

H1: Psychological dimension has a positive effect on OHS performance.

2.2. The Effect of Behavioral Dimension on OHS Performance

The behavioral dimension involves actual actions workers take to stay safe, such as following procedures, using PPE consistently, and reporting hazards. It reflects whether safety values are truly internalized or remain superficial. Cooper (2000) explains that behaviors result from learning processes influenced by feedback, observation, and reinforcement in the workplace. Consistent safe acts become habits when supported by positive consequences and fair discipline. Reason (2016) stresses that visible behaviors signal the strength of underlying culture, especially in reporting near-misses without fear. In daily operations, inconsistent behaviors like skipping PPE often stem from comfort or time pressure rather than malice.

This dimension connects to OHS performance by directly reducing unsafe acts that cause incidents. Strong behavioral alignment leads to fewer violations and better leading indicators such as active participation, hazard reporting, and compliance with safety procedures. Vinodkumar and Bhasi (2010) demonstrated that safe behaviors mediate the link between management practices and performance outcomes. Altawal (2023) confirmed that engaged workers show more consistent safe actions, improving overall safety results. In contractor-heavy settings, behaviors are crucial because workers face varying tasks and must adapt quickly while following main company standards. Moreover, consistent reinforcement of safe behavior through supervision, training, and feedback mechanisms strengthens workers' safety awareness and risk perception. This is particularly important in dynamic and high-risk environments, where behavioral discipline and proactive safety participation significantly contribute to preventing accidents and sustaining long-term OHS performance.

H2: Behavioral dimension has a positive effect on OHS performance.

2.3. The Effect of Situational Dimension on OHS Performance

The situational dimension includes organizational systems, policies, procedures, resources, and leadership support that enable safe work. It provides the structural backbone for safety efforts. Cooper (2000) describes this as the external framework such as clear rules, inspection systems, and follow-up mechanisms that shapes and sustains safe environments. Effective situational factors ensure resources like proper PPE and training are available and used. ESDM (2024) highlights that in oil and gas, situational support through management systems and three pillars (technical, system, human) underpins mature safety culture. Weak systems lead to gaps in implementation despite good intentions.

This dimension strongly affects OHS performance by creating conditions where safe behaviors can thrive. Good policies and consistent follow-up reduce risks and encourage reporting. Bautista et al. (2024) found that supportive systems not only improve safety but also bring financial benefits. Zwetsloot et al. (2020) noted that proactive systems with effective reporting enhance prevention. In Balikpapan operations, situational factors like audit follow-up and resource allocation are vital for contractors facing high-risk tasks. Clear standard operating procedures, timely corrective actions, and transparent communication channels further strengthen compliance and reduce ambiguity in task execution. Moreover, when management consistently allocates adequate safety budgets and ensures systematic monitoring, contractors are more likely to internalize safety priorities as part of daily operational routines rather than viewing them as administrative obligations.

H3: Situational dimension has a positive effect on OHS performance.

2.4. Simultaneous Effect on OHS Performance

Safety culture refers to the shared values, beliefs, and practices that prioritize safety in daily work, shaping how individuals perceive and respond to risks. Cooper (2000) explains that safety culture develops through the interaction of psychological (attitudes and perceptions), behavioral (safe actions), and situational (systems and policies) factors, which influence one another over time. Guldenmund (2000) adds that it includes underlying assumptions and visible norms guiding risk management, while Reason (2016) highlights reporting, just, learning, and flexible cultures as key elements of adaptive safety systems. These concepts are closely linked to OHS performance, which measures an organization's effectiveness in preventing incidents through leading and lagging indicators. The ILO (2020) emphasizes that effective OHS requires integration of human and system factors, and research confirms that a strong safety culture improves compliance and overall safety outcomes (Naji et al., 2021).

The hypothesis that safety culture dimensions (psychological, behavioral, and situational) simultaneously positively influence OHS performance among contractor workers is supported theoretically and empirically. The psychological dimension shapes workers' safety perceptions and commitment, the behavioral dimension reflects safety compliance and participation, and the situational dimension includes leadership, systems, and communication that enable safe practices; when integrated, these elements form a strong safety culture that enhances safety outcomes. Empirical evidence shows that psychosocial safety climate improves safety behavior and engagement, leading to better safety performance (Dera et al., 2025). In addition, safety climate has been found to significantly predict safety behavior and safety performance in construction settings, emphasizing the importance of organizational support and worker participation (Heryati et al., 2019; Newaz et al., 2020).

H4: Psychological, behavioral, and situational simultaneously has a positive effect on OHS performance.

This study integrates the three dimensions of safety culture as independent variables influencing OHS performance as the dependent variable. The framework draws from Cooper's (2000) reciprocal model, where psychological, behavioral, and situational factors interact to shape safety outcomes. It assumes that each dimension contributes uniquely but together they create stronger effects in high-risk contractor settings. The model posits direct positive relationships, tested through empirical data from Balikpapan workers. This approach addresses gaps in prior studies by examining combined impacts rather than isolated views.

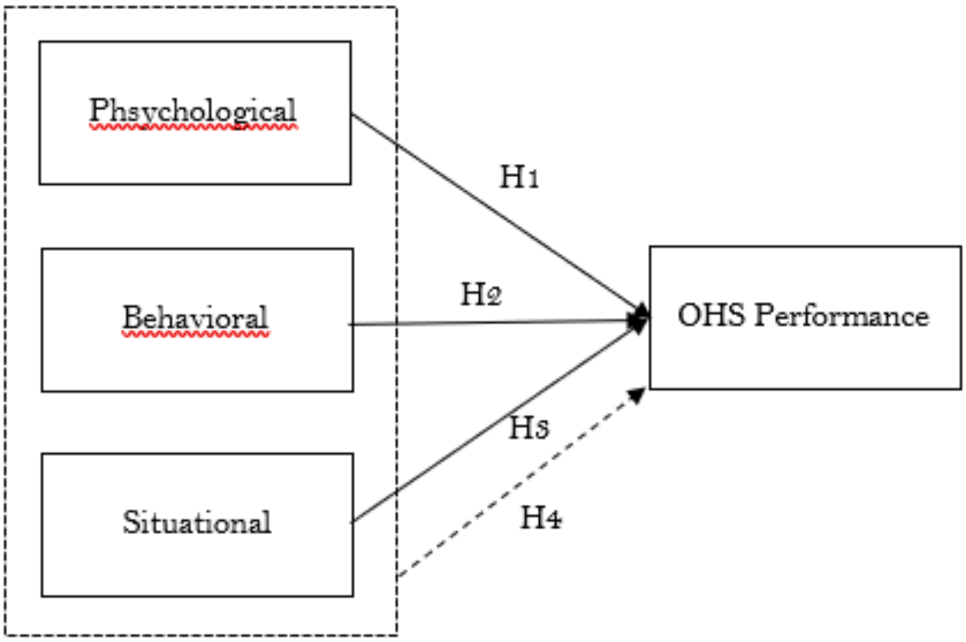


Figure 1. Research Framework

The framework highlights the need for balanced development across dimensions to achieve optimal OHS. It guides the analysis toward understanding how perceptions, actions, and systems work together. Figure 1 illustrates these relationships, showing arrows from each safety culture dimension to OHS performance, with situational often showing the strongest path based on industry context.

3. Methods

This study employed a quantitative research approach with a cross-sectional design to examine the influence of safety culture dimensions on Occupational Health and Safety (OHS) performance among contractor workers in Balikpapan's oil and gas industry (Sugiyono, 2017). Data were collected through a structured questionnaire distributed to 382 contractor workers actively involved in high-risk activities at the refinery site during the Refinery Development Master Plan (RDMP) project period in 2025. The sample was selected using a non-probability convenience sampling technique, as this method allowed access to available workers across various disciplines such as civil, electrical, instrument, mechanical, and piping, while ensuring representation from different work durations and job types. The questionnaire consisted of closed-ended items measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). All respondents provided informed consent prior to participation, and confidentiality was guaranteed to encourage honest responses. The instrument was adapted from established scales in safety culture literature and pre-tested with 30 workers to check clarity and reliability before full distribution. Data were collected over six weeks through on-site distribution during safety briefings and shift changes, with supervisor assistance to ensure access while maintaining voluntary participation. Completed questionnaires were screened, and incomplete responses were excluded from the final dataset.

The independent variables psychological, behavioral, and situational dimensions of safety culture were measured using multi-item scales derived from Cooper's (2000) reciprocal safety culture model. The psychological dimension included items assessing perceptions, attitudes, and trust in management commitment to safety. The behavioral dimension captured actual safe practices, such as consistent use of personal protective equipment, adherence to procedures, and willingness to report hazards. The situational dimension evaluated organizational support, including availability of resources, clarity of procedures, effectiveness of reporting systems, and follow-up on safety issues. The dependent variable, OHS performance, was assessed through self-reported indicators such as compliance with safety rules, participation in safety programs, frequency of near-miss reporting, and perceived reduction in unsafe conditions. All constructs demonstrated good internal consistency, with Cronbach's alpha values exceeding 0.70 after minor item refinement based on pilot testing.

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software, chosen for its suitability in handling complex models with reflective constructs and smaller sample requirements. The analysis followed a two-step process: first, evaluation of the outer model (measurement model) through convergent validity (factor loadings > 0.70), discriminant validity (cross-loadings and Fornell-Larcker criterion), and composite reliability; second, assessment of the inner model (structural model) via path coefficients, t-statistics, p-values (using bootstrapping with 5,000 subsamples), R-square, and effect size (f^2). This approach allowed testing of both direct effects of individual dimensions and the simultaneous influence of all three dimensions on OHS performance, providing robust evidence for the proposed relationships in the research framework.

4. Results

This section presents the findings from the data analysis conducted on 382 contractor workers in Balikpapan's oil and gas industry. The results are organized to first describe the respondent characteristics, followed by the evaluation of the measurement model (outer model), model fit, and finally the structural model (inner model) outcomes, including the testing of the four hypotheses. All analyses were performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.0 software. The presentation focuses on objective reporting of descriptive statistics, validity and reliability indicators, and path coefficient results without interpretation at this stage.

Table 1. Characteristic Respondent

Characteristic	Items	Total	Percentage (%)
Gender	Male	34	6%
	Female	358	94%
Age	<20 y.o	9	2%
	20-29 y.o	192	50%
	30-39 y.o	105	28%
	40-49 y.o	63	17%
	>50 y.o	13	3%
Education	SD	2	1%
	SMP	16	4%
	SMA/Sederajat	275	72%
	D3	25	7%
	D4	5	1%
	S1	59	15%
Length of Service	<2 tahun	224	59%
	>2-5 years	148	39%
	>5 years	10	2%
Type of Work	Civil	20	5%
	Electrical	80	21%
	Instrument	96	25%
	Mechanical	85	22%
	Piping	101	27%

Table 1 shows the respondent profile, which shows a diverse group of contractor workers involved in high-risk activities. In terms of gender, the majority were male (89%), with females accounting for 11%. Age distribution indicated that most respondents were between 26 and 35 years old (58%), followed by 36–45 years (28%), under 25 years (9%), and above 45 years (5%). Regarding work experience, 59% had less than 2 years of tenure, 39% had 2–5 years, and only 2% had more than 5 years. By job type, piping workers represented the largest group (27%), followed by instrument (25%), mechanical (22%), electrical (21%), and civil (5%). These characteristics reflect the typical composition of contractor personnel in refinery expansion projects, where younger and relatively new workers dominate due to the labor-intensive nature of the tasks.

Table 2. Results of Outer Loading Convergent Validity – Stage 1-3

Stage	Latent Variable	Number of Indicators	Valid (≥ 0.70)	Invalid (< 0.70)
Stage 1	Psychological Dimension	6	5	1
	Behavioral Dimension	8	6	2
	Situational Dimension	8	8	0
	OHS Performance	12	11	1
	Total	34	30	4
Stage 2	Psychological Dimension	5	5	0
	Behavioral Dimension	6	5	1
	Situational Dimension	8	8	0
	OHS Performance	11	11	0
	Total	30	29	1
Stage 3	Psychological Dimension	5	5	0
	Behavioral Dimension	5	5	0
	Situational Dimension	8	8	0
	OHS Performance	11	11	0
	Total	29	29	0

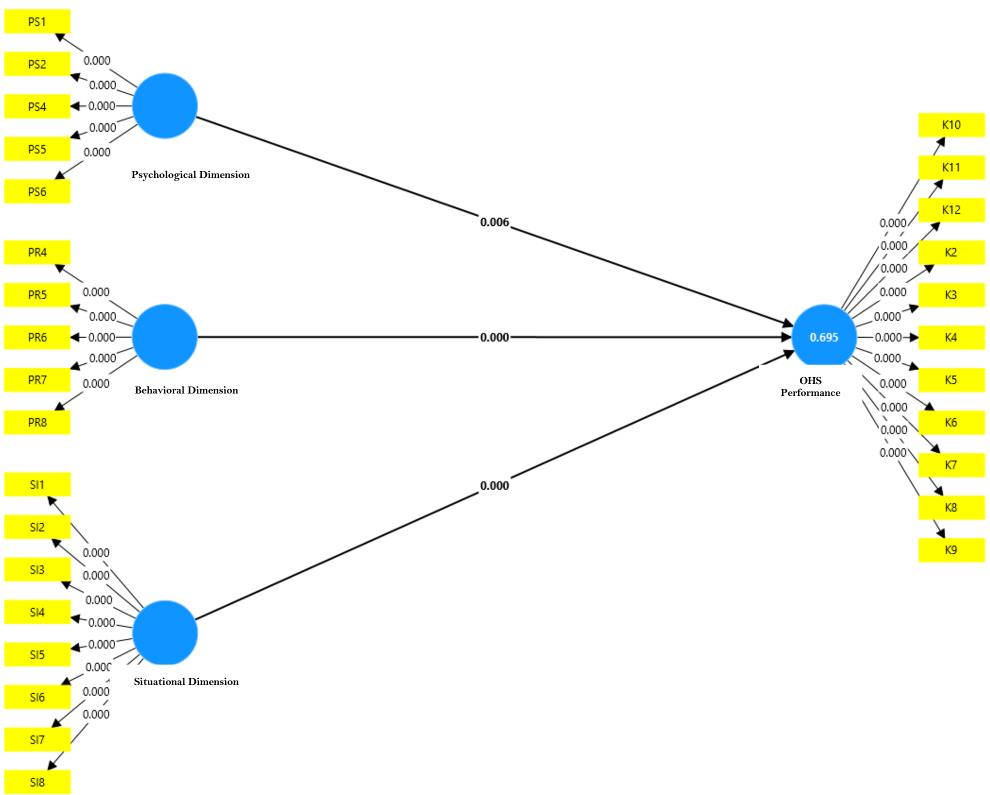


Figure 2. First-order bootstrapping model

Table 2 shows, and Figure 2, the first-order bootstrapping model. The outer model evaluation began with a convergent validity assessment through factor loadings. In the initial stage, several items fell below the 0.70 threshold: one item from the psychological dimension (PS3 = 0.695), two from the behavioral dimension (PR2 = 0.674, PR3 = 0.689), and one from OHS performance (K1 = 0.697). These four items were removed, and the model was re-estimated. In the second stage, one remaining behavioral item (PR1 = 0.699) was still below 0.70 and was eliminated. After the third iteration, all retained items achieved loadings above 0.70, ranging from 0.715 to 0.838, confirming convergent validity as recommended by Hair et al. (2014).

Table 3. Results of Cross Loadings for Discriminant Validity & Reliability

Latent Variable	Number of Indicators	Valid	Invalid	Cronbach's Alpha
Psychological Dimension	5	5	0	0.835
Behavioral Dimension	5	5	0	0.825
Situational Dimension	8	8	0	0.910
OHS Performance (K3)	11	11	0	0.932
Total	29	29	0	

Table 3 shows discriminant validity was examined using cross-loadings. Each indicator loaded highest on its respective construct compared to other constructs, satisfying the criterion that an indicator's correlation with its own construct must exceed its correlations with others. This pattern held across all retained items, indicating that the constructs were empirically distinct. Reliability was further supported by Cronbach's alpha values: psychological dimension (0.835), behavioral dimension (0.825), situational dimension (0.910), and OHS performance (0.932). All values were well above 0.70, confirming internal consistency.

Table 4. Results of Model Fit Assessment

Parameter	Rule of Thumb	Estimated Model	Description / Remark
SRMR	< 0.10	0.061	Fit
GoF	0.1 (small GoF), 0.25 (moderate GoF), 0.36 (substantial / strong GoF)	0.64	Fit

Table 4 shows model fit indices demonstrated that the overall PLS-SEM model was appropriate for the data. The Standardized Root Mean Square Residual (SRMR) was 0.061, below the recommended threshold of 0.10, indicating a good fit between the observed data and the hypothesized model. The Goodness of Fit (GoF) value reached 0.644, far exceeding the 0.36 benchmark for a strong global fit. These results suggest that the model adequately represents the relationships among the variables.

Table 5. Results of R-Square (R^2) and Effect Size (f^2)

Variable	R-Square (R^2)	R-Square Adjusted	f^2 Effect Size	Interpretation (Common Thresholds)
OHS Performance	0.695	0.692	-	Substantial / High explanatory power
Behavioral Dimension	-	-	0.070	Small effect
Psychological Dimension	-	-	0.009	No / negligible effect (< 0.02)
Situational Dimension	-	-	0.504	Large effect

Table 5 shows that the structural model results revealed substantial explanatory power for OHS performance. The R-square value for OHS performance was 0.695, meaning that the three safety culture dimensions together explained 69.5% of the variance in OHS performance, with the remaining 30.5% attributable to other unmodeled factors. This level falls between moderate (0.50) and strong (0.75) explanatory power according to Hair et al. (2014). Effect sizes (f^2) provided insight into the relative contribution of each dimension. The situational dimension showed the largest effect with $f^2 = 0.504$ (large), followed by the behavioral dimension at $f^2 = 0.070$ (medium), and the psychological dimension at $f^2 = 0.009$ (very small).

Table 6. Results of Path Coefficient Bootstrapping (First-Order Model)

Variable Relationship	Original Sample	Sample Mean	Std. Dev	t-statistics	p-values	Remark
Psychological Dimension → OHS Performance	0.111	0.113	0.044	2.536	0.006	Supported
Behavioral Dimension → OHS Performance	0.215	0.214	0.054	3.958	0.0001	Supported
Situational Dimension → OHS Performance	0.580	0.579	0.053	11.011	0.0001	Supported

Table 6 shows that path coefficient analysis using bootstrapping with 5,000 subsamples examined the direct effects of the safety culture dimensions on OHS performance. The psychological dimension showed a positive and statistically significant effect (β = 0.111; t = 2.536; p = 0.006). The behavioral dimension also demonstrated a positive and significant influence (β = 0.215; t = 3.958; p = 0.001). The situational dimension had the strongest direct effect on OHS performance (β = 0.580; t = 11.011; p = 0.001).

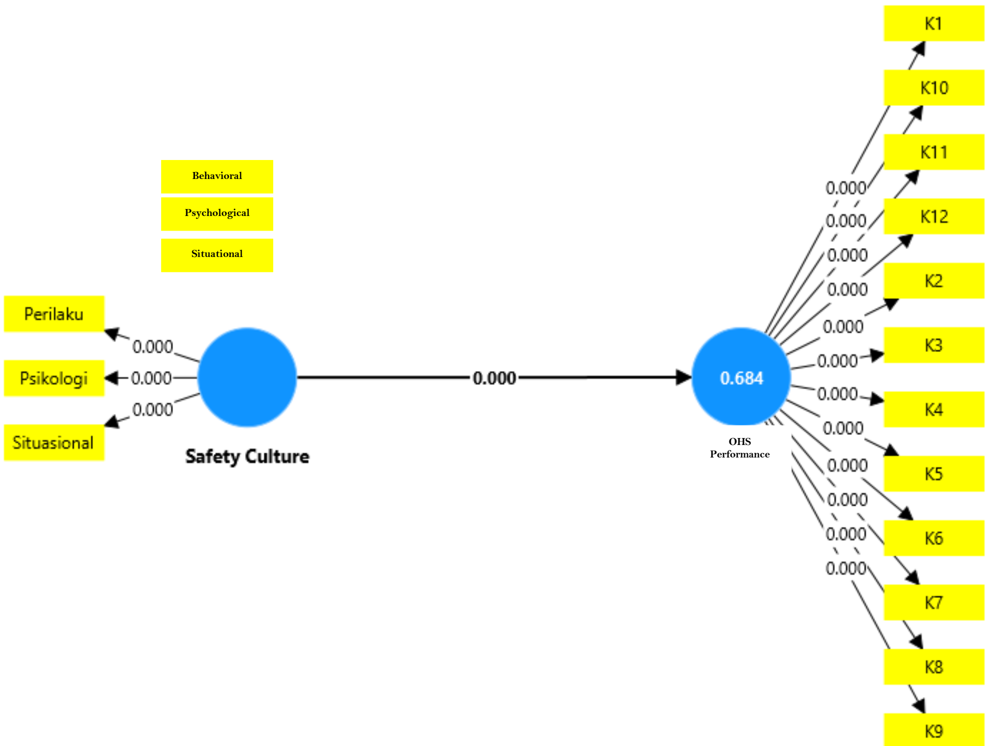
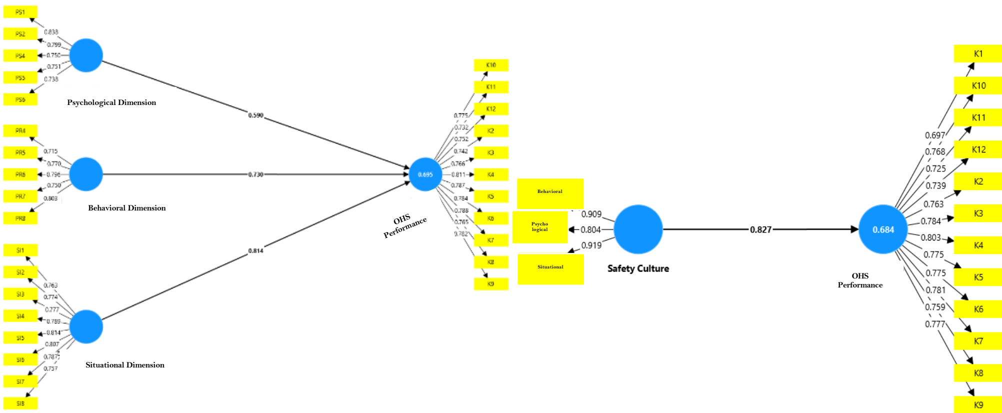


Figure 3. Second Order Boostrapping Model

Table 7. Results of Path Coefficient Bootstrapping (Second-Order Model)

Variable Relationship	Original Sample	Sample Mean	Std. Dev	t-statistics	p-values	Remark
Safety Culture → OHS Performance	0.827	0.826	0.027	30.847	0.0001	Supported

Table 7 presents the results of the second-order path coefficient bootstrapping analysis, while Figure 3 illustrates the second-order bootstrapping model. The findings indicate that Safety Culture, conceptualized as a higher-order construct comprising psychological, behavioral, and situational dimensions, exerts a very strong and statistically significant effect on OHS performance (β = 0.827; t = 30.847; p = 0.001). The high t-statistic and near-zero p-value confirm the robustness of the model, demonstrating that the integrated influence of all three dimensions substantially enhances OHS performance. This result suggests that OHS performance is more powerfully explained when safety culture is treated as a holistic and multidimensional construct rather than as separate dimensions.



(a) (b)

Figure 4. (a) Final first-order PLS-SEM model (b) Second order Model

Figure 4(a) shows that, among the indicators within each dimension, certain items stood out. In the psychological dimension, the highest outer loading belonged to leadership commitment (0.838), while perceived effectiveness of OHS implementation scored lowest (0.738). For the behavioral dimension, safety in reporting unsafe conditions or actions achieved the highest loading (0.803), whereas PPE condition received the lowest (0.715). In the situational dimension, the reporting system indicator had the highest loading (0.814), while management support scored lowest (0.757). And in Figure 4(b) in the second-order model, the situational dimension obtained the highest weight (0.909), followed by behavioral (0.854) and psychological (0.804). These patterns highlight which specific aspects within each dimension were most prominent among the respondents.

5. Discussion

The findings of this study demonstrate that safety culture, through its psychological, behavioral, and situational dimensions, exerts a significant positive influence on OHS performance among contractor workers in Balikpapan's oil and gas industry. The situational dimension emerged as the strongest predictor, followed by the behavioral dimension, while the psychological dimension showed the weakest but still significant direct effect. When examined simultaneously, the three dimensions together explained nearly 70% of the variance in OHS performance, highlighting their complementary and reinforcing roles in shaping safety outcomes. These results align with the reciprocal model proposed by Cooper (2000), which emphasizes that safety culture is not a single construct but an interplay of internal perceptions, observable actions, and external organizational support systems.

The dominant role of the situational dimension supports the view that structural and systemic factors provide the essential foundation for effective safety practices in high-risk environments. In the context of refinery operations involving thousands of contractors, clear procedures, reliable reporting mechanisms, adequate resources, and consistent follow-up on safety issues appear to create the conditions necessary for safe behavior to occur reliably. This finding resonates with ESDM (2024), which underscores the importance of the three pillars technical safety, management systems, and human-organizational factors in building mature safety culture within the Indonesian oil and gas sector. It also echoes Bautista et al. (2024), who found that supportive organizational systems not only enhance safety performance but also contribute to broader operational and financial benefits. The relatively smaller but significant contribution of the behavioral dimension indicates that individual actions such as consistent PPE use, procedure adherence, and proactive hazard reporting translate safety values into tangible outcomes, consistent with Vinodkumar and Bhasi (2010), who highlighted behavior as a critical mediator between management practices and safety results.

Interestingly, the psychological dimension, although statistically significant, exhibited the smallest effect size. This suggests that while positive perceptions, trust in leadership commitment, and belief in the value of safety are important, they may not directly drive performance unless reinforced by strong systems and consistent behavioral reinforcement. According to Naji et al. (2021), psychological factors often act indirectly by reducing psychosocial risks and increasing worker engagement, a pattern that seems partially reflected here given the modest direct path. Abeje and Luo (2023) similarly noted that safety perceptions strengthen when mediated by involvement and supportive climate, which may explain why psychological aspects showed limited standalone impact in this contractor-heavy setting where workers frequently change tasks and sites. The overall simultaneous effect of the three dimensions further confirms that isolated improvements are insufficient; integrated development across perceptions, actions, and systems yields the most substantial gains, in line with Reason's (2016) emphasis on adaptive, learning-oriented cultures.

These results carry important implications for practice in Balikpapan's expanding refinery projects. Management should prioritize strengthening situational elements such as enhancing reporting systems, ensuring timely follow-up on audit findings, and providing adequate PPE and training resources as these factors appear to offer the highest leverage for improving OHS performance. At the same time, behavioral interventions, including behavior-based safety programs (PEKA) and regular feedback on safe acts, remain essential to bridge the gap between policy and daily practice. Although psychological aspects showed a weaker direct link, sustained efforts to build trust through visible leadership commitment, open communication during toolbox meetings, and recognition of safe behaviors can gradually strengthen the foundational mindset needed for long-term cultural maturity. By addressing all three dimensions in an integrated manner, companies can move closer to zero-accident goals, reduce near-miss incidents, and create safer, more sustainable work environments for contractor personnel in high-risk oil and gas operations.

6. Conclusion

The study concludes that safety culture, encompassing its psychological, behavioral, and situational dimensions, significantly and positively influences OHS performance among contractor workers in Balikpapan's oil and gas industry. The situational dimension emerged as the most dominant factor, followed by the behavioral dimension, while the psychological dimension showed a weaker but still meaningful direct effect. When considered together, the three dimensions explained a substantial portion of the variance in OHS performance, underscoring that safety outcomes in high-risk contractor environments depend heavily on the interplay of organizational systems, consistent safe actions, and supportive worker perceptions rather than any single aspect alone.

These findings carry several practical implications for the industry. Management should prioritize strengthening situational elements, such as improving reporting systems, ensuring consistent follow-up on safety audits, and providing adequate resources and training, as these offer the greatest potential to elevate OHS performance. At the same time, ongoing behavioral reinforcement through programs like PEKA and visible leadership engagement can help translate policies into daily practice, while efforts to build trust and awareness address the relatively weaker psychological foundation. However, the study has limitations, including reliance on self-reported data which may introduce response bias, a cross-sectional design that prevents establishing causality over time, and a focus on one specific refinery site in Balikpapan, which may limit generalizability to other oil and gas contexts or regions. Future research could adopt longitudinal approaches to track changes in safety culture and performance, incorporate objective measures such as incident records or observational data, and expand the sample to include multiple sites or permanent employees for broader insights.

References

Abeje, M., & Luo, F. (2023). The influence of safety culture and climate on safety performance: Mediating role of employee engagement in manufacturing enterprises in Ethiopia. *Sustainability, 15*(14), 112-124.

Altawal, A., Arakzeh, M., & El-Ashi, R. (2023). Promoting a Culture of Behavior-Based Safety (BBS). In *SPE Middle East Oil and Gas Show and Conference* (p. 116-135). Texas: SPE.

Aula, H. R., Kurniasih, D., & Rachman, F. (2021). Psychological capital impacts on safety behavior of contractor workers using the SEM method. *The Indonesian Journal of Occupational Safety and Health, 10*(2), 180–187.

Bautista-Bernal, I., Quintana-García, C., & Marchante-Lara, M. (2024). Safety culture, safety performance and financial performance. A longitudinal study. *Safety science, 172*(20), 106-119.

Cooper, M. D. (2000). Towards a model of safety culture. *Safety Science, 36*(2), 111–136.

Dera, A. K., Adedokun, M. W., & Iyiola, K. (2025). The psychosocial safety climate's influence on safety behavior and employee engagement: Does safety leadership really count? *Behavioral Sciences, 15*(2), 179.

ESDM. (2024). *ATLAS keselamatan migas.* Retrieved on August 12, 2025, from https://migas.esdm.go.id/Buku-Referensi-1

Ghozali, I. (2016). *Aplikasi analisis multivariete dengan program IBM SPSS 23* (Edisi 8). Semarang: Badan Penerbit UNDIP.

Guldenmund, F. W. (2000). The nature of safety culture: A review of theory and research. *Safety Science, 34*(1–3), 215–257.

Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM) an emerging tool in business research. *European Business Review, 26*(2), 106–121.

Heryati, A. N., Nurahaju, R., Nurcholis, G., & Nurcahyo, F. A. (2019). Effect of safety climate on safety behavior in employees: The mediation of safety motivation. *Psikohumaniora: Jurnal Penelitian Psikologi, 4*(2), 191-200.

ILO. (2020). *Safety + health for all. An ILO flagship programme: Key facts and figures (2016-2020).* Retrieved on August 20, 2025, from https://www.ilo.org/global/topics/safety-and-health-at-work/lang--en/index.htm.

Indrayani, I., & Kusumojanto, D. D. (2020). An occupational safety and health management system to minimize work accidents. *JBMI (Jurnal Bisnis, Manajemen, Dan Informatika), 17*(2), 162-166.

IOGP. (2021). *Safety performance indicators.* Retrieved on August 25, 2025 from https://www.iogp.org

Jasiulewicz-Kaczmarek, M., Antosz, K., Wyczółkowski, R., & Sławińska, M. (2022). Integrated approach for safety culture factor evaluation from a sustainability perspective. *International journal of environmental research and public health*, *19*(19), 118-129.

Karya, A. F. D. (2021). Kajian singkat terhadap penanganan keselamatan dan kesehatan kerja di sektor migas. *Riset Sains dan Teknologi Kelautan*, *5*(3), 59-61.

Kontogiannis, T., Leva, M. C., & Balfe, N. (2017). Total safety management: principles, processes and methods. *Safety science*, *100*(10),128-142.

Kumar, P., Veluri, A., Palagummi, S. V., Al Dhaheri, S. M., Bazuhair, A., & Surendran, S. (2024). Transforming reactive into proactive monitoring through effective lessons learned and enhanced safety culture to prevent incidents. In *SPE International Conference and Exhibition on Health, Safety, Environment, and Sustainability?* (p. D012S014R001). Texas: SPE.

Ministry of Energy and Mineral Resources. (2017). *Regulation of the Minister of Energy and Mineral Resources Number 38 of 2017 concerning safety inspections of installations and equipment in oil and gas business activities.*

Naji, G. M. A., Isha, A. S. N., Mohyaldinn, M. E., Leka, S., Saleem, M. S., Rahman, S. M. N. B. S. A., & Alzoraiki, M. (2021). Impact of safety culture on safety performance; mediating role of psychosocial hazard: An integrated modelling approach. *International Journal of Environmental Research and Public Health*, *18*(16), 85-98.

Nelson, A., & Zega, Y. A. (2021). Influence of occupational health safety (OHS) culture, commitment management, OHS training on OHS performance in oil & gas contractors company in Batam Island. *Journal of Business Studies and Management Review*, *4*(2), 111–118.

Newaz, M. T., Davis, P., Jefferies, M., & Pillay, M. (2019). The psychological contract: A missing link between safety climate and safety behaviour on construction sites. *Safety Science*, *112*(10), 9-17.

Nugroho, R. E., Agustinus Hariadi, D. P., & Shofa, M. J. (2023). Effect of OHS, work accidents, work culture and OHS Competence on OHS performance in national construction companies. *Saudi J Bus Manag Stud*, *8*(8), 171-177.

Pagoray, G. L. (2022). Penilaian risiko K3 dengan metode HIRARC dan safety policy pada preservasi jalan Oransbari-Mameh di Kabupaten Manokwari. *Jurnal Ilmiah Ecosystem*, *22*(3), 475–486.

Pradja, B. P., & Wibowo, S. N. (2022). The effect of occupational health safety (K3) and work environment on employee performance. *IJESS International Journal of Education and Social Science*, *3*(2), 82–89.

PT KPB. (2025). *PT Kilang Pertamina Balikpapan*. Retrieved on October, 25, 2025 from https:/kpb.pertamina.com/en

Reason, J. (2016). *Managing the risks of organizational accidents*. London: Routledge.

Setiawan, F., & Astutik, M. (2022). The effect of training, supervision and occupational safety and health (K3) culture on employee performance. *Indonesian Journal of Law and Economics Review*, *17*(4), 65-72.

Sugiyono. (2017). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta

Tamon, O., Setiawan, E. W., & Sapsudin, A. (2025). Legal protection for doctors under Law Number 17 of 2023 concerning health. *Research Horizon*, *5*(4), 1281-1292.

Thomas, M. J. (2012). *A systematic review of the effectiveness of safety management systems* (No. AR-2011-148). Cham: Springer.

Timbang, A., Prasad, D. M. R., & Azri, M. H. (2023). The perspective of leadership and management commitment in process safety management. *Indian Chemical Engineer*, *65*(4), 381–394.

Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation. *Accident Analysis & Prevention*, *42*(6), 2082–2093.

Zwetsloot, G., Leka, S., Kines, P., & Jain, A. (2020). Vision zero: Developing proactive leading indicators for safety, health and wellbeing at work. Safety Science, *130*(12), 104-111.

Acknowledgment
We gratefully acknowledge the contributions of individuals who supported the completion of this article.

Funding Information
This research did not receive any funding.

Conflict of Interest Statement
The authors declare that there is no conflict of interest.

Ethical Approval and Originality Statement
Ethical approval was obtained for this study. The manuscript represents original work and has not been previously published, nor is it under consideration by another journal.

Data Disclosure Statement
The data that support the findings of this study are available from the corresponding author upon reasonable request.