

INFLUENCE OF POLICIES, WORKER FACTORS, ENVIRONMENT, AND SUPERVISION ON OSH IMPLEMENTATION AT BALONGAN REFINERY UNIT VI

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Abstract

The International Labour Organization (ILO) reports more than 2.78 million deaths annually due to work-related accidents and diseases, along with approximately 374 million non-fatal accidents. The novelty of this research lies in testing a comprehensive model that integrates four organizational and human factors with safety culture as a mediator, which is rarely applied in Indonesia's oil and gas industry. This study investigates the effects of OHS policy commitment, worker factors, work environment, and supervision on OHS implementation, with safety culture as a mediating variable, at Balongan Refinery Unit (RU) VI. Using an explanatory quantitative approach, 165 employees were surveyed and analyzed with SEM-PLS. Findings reveal that worker factors significantly influence both OHS implementation and safety culture, while policy commitment and supervision affect safety culture but not implementation. The work environment has no significant role, and safety culture was not confirmed as a mediator. Worker compliance emerged as the strongest determinant, whereas OHS knowledge was the weakest aspect. Though focused on RU VI, the results offer broader insights for other refinery units with similar high-risk operations.

Keywords: OHS; Oil and gas industry; Safety culture; Supervision; Worker factors.

INTRODUCTION

The oil and gas industry is one of the sectors with a high level of occupational accident risk, and implementing Occupational Safety and Health (OSH) is a strategic factor in ensuring worker safety and operational continuity. The complexity of production processes, exposure to hazardous materials, and high operational demands require an integrated OSH management system that encompasses policy commitment, workforce quality, workplace conditions, and the effectiveness of supervision (1). However, global data show that OSH issues remain significant. The International Labour Organization (ILO) reports more than 2.78 million deaths annually due to work-related accidents and diseases, along with approximately 374 million non-fatal accidents (2). In Indonesia, the Ministry of Manpower recorded 265,334 occupational accident cases in 2022, an increase from the previous year (3).

About 60% of respondents assessed that workers' understanding of OSH procedures remains low, particularly among new employees and contractors. Most respondents considered the

workplace environment adequate, yet complaints regarding lighting and ventilation persist. Supervision was identified as a relatively weak aspect, especially during night shifts. This indicates that the success of OSH implementation depends not only on formal policies but also on the quality of execution, worker involvement, and the effectiveness of supervision.

Previous studies have highlighted the crucial role of managerial commitment (4)(5), worker-related factors (6), workplace environment, and supervision (7)(8) in shaping OSH performance. However, most studies have examined these variables partially rather than within a holistic framework. Some research has also emphasized the importance of safety culture as a mediating factor that can strengthen the influence of organizational factors on safety performance (9). Accordingly, studies that integrate the four main factors with safety culture as an intervening variable in Indonesia's oil and gas industry remain limited.

The novelty of this study lies in simultaneously testing the effects of OSH policy commitment, worker-related factors, workplace environment, and

supervision on OSH implementation, while considering safety culture as a mediating variable. This approach enables the comprehensive identification of both direct and indirect influence pathways, which is rarely conducted in studies within the national oil and gas sector. In addition, this study employs Structural Equation Modeling (SEM) based on Partial Least Squares to analyze complex relationships among variables, thereby providing a deeper understanding of the mechanisms of OSH implementation in high-risk work environments.

This study aims to: (1) analyze the influence of OHS policy commitment on OHS implementation; (2) examine the effect of worker-related factors on OHS implementation; (3) assess the influence of the workplace environment on OHS implementation; (4) analyze the impact of supervision on OHS implementation; and (5) test the role of safety culture as a mediating variable in these relationships. The selection of these four factors is based on their consistent identification in prior OHS literature as the core organizational and human determinants in high-risk industries, particularly oil and gas, where policy, workforce behavior, work

conditions, and supervision directly interact with frontline operations. Other potential factors such as workload, leadership style, or job stress were acknowledged but excluded to maintain a parsimonious model and ensure analytical clarity. The findings are expected to contribute theoretically by enriching the OHS implementation framework and practically by guiding Balongan RU VI in formulating integrated and sustainable safety strategies.

RESEARCH METHODS

The study involved 1,282 employees of RU VI Balongan, consisting of 942 permanent and 340 outsourced workers, with 165 respondents selected purposively based on at least one year of service, active work in OHS-related units, and willingness to participate, while those on leave or with incomplete responses were excluded. The minimum sample size requirement of 165–330 (5–10 respondents per 33 indicators) was met, and PLS-SEM was deemed suitable given its robustness for small samples. Primary data were collected through a five-point Likert questionnaire via Google Forms, complemented with secondary data from journals, reports, and official documents.

Cleaned data were analyzed using SmartPLS 4, with measurement model evaluation assessing validity and reliability (loading factor >0.7, AVE >0.5, composite reliability and Cronbach’s Alpha >0.7, and discriminant validity via Fornell–Larcker and cross-loading), and structural model evaluation examining R², f², Q² (>0), SRMR (<0.10), and path significance through bootstrapping with 5,000 resamples (t >1.96, p <0.05).

RESULTS AND DISCUSSION

Results

This study employed the Partial Least Squares – Structural Equation Modeling (PLS-SEM) method to examine the influence of OSH policy commitment, worker-related factors, workplace environment, and supervision on OSH implementation, with safety culture as a mediating variable. The respondents comprised 165 employees, primarily male

(97%), with more than 10 years of work experience (75%).

After eliminating two indicators that did not meet the criteria, the outer model assessment showed that all indicators were valid, with loading factor values greater than 0.7. The Cronbach’s Alpha values for all variables exceeded 0.9, indicating excellent reliability. The discriminant validity test also met the established criteria, confirming that each construct was measured appropriately. Cronbach’s Alpha values are presented in Table 1.

Table 2 presents the results of the model fit test, showing SRMR = 0.057, GoF = 0.82, and Q² > 0, which indicate that the model possesses strong goodness-of-fit and predictive relevance (15, 16). The R² value for OSH implementation was 0.865, and for safety culture 0.859, demonstrating that the model could explain more than 85% of the variance in both dependent variables.

Table 1. Cronbach’s Alpha

Variable	Cronbach's alpha	
Worker Factors	0.931	
Policy Commitment	0.934	
Workplace Environment	0.930	
OSH Implementation	0.926	
Supervision	0.937	
Safety Culture	0.949	
Dependent Variable	R-square	R-square adjusted
OSH Implementation	0.865	0.861
Safety Culture	0.859	0.855

Source: Data Processing, 2025

In the hypothesis testing of direct effects, four significant relationships were identified: (1) Worker Factors → OSH Implementation ($\beta = 0.489$; $p < 0.001$), (2) Worker Factors → Safety Culture ($\beta = 0.199$; $p = 0.007$), (3) Policy Commitment → Safety Culture ($\beta = 0.231$; $p = 0.019$), and (4) Supervision → Safety Culture ($\beta = 0.465$; $p < 0.001$).

Meanwhile, the direct effects of policy commitment, workplace environment, and supervision on OSH implementation were insignificant ($p > 0.05$). Similarly, the effect of the workplace environment on safety culture was also negligible. This non-significant result may be explained by two possible factors. First, most respondents perceived workplace conditions such as lighting and ventilation as already adequate, resulting in low variability across responses. Second, the measurement instrument primarily emphasized physical aspects and may not have fully captured behavioral or perceptual dimensions of the work

environment. These considerations suggest that the limited variance and scope of measurement could partly explain the absence of a significant statistical effect.

Based on Figure 1, the PLS-SEM Algorithm output shows the relationships among latent variables measured through path coefficients and R^2 values. The R^2 value for Safety Culture was 0.859 and for OSH Implementation was 0.865, indicating that more than 85% of the variability of both dependent variables was explained by the independent constructs in the model, which is considered very strong (15, 16). The most substantial direct effect was found for Worker Factors ($\beta = 0.489$), followed by Safety Culture ($\beta = 0.172$), while Policy Commitment, Workplace Environment, and Supervision showed relatively more minor direct effects ($\beta = 0.130$; $\beta = 0.078$; $\beta = 0.108$). This indicates that worker behavior and compliance quality are the primary determinants of successful OSH implementation (17).

Tabel 2. Model Fit Test Results

Parameter	Rule of thumb	Estimated model	Keterangan
SRMR	<0.10	0.057	Fit
d ULS	>0.05	1.614	Fit
d G	>0.05	2.011	Fit
Chi-square	χ^2 statistik $\geq \chi^2$ tabel	1.680.318 \geq 44.985	Fit
NFI	Close to 1	0.770	Fit
GoF	0.1 (GOF small), 0.25 (Gof moderate), 0,36 (Gof strong)	0.82	Fit

Parameter	Rule of thumb	Estimated model	Keterangan
Q ² Predictive Relevance	Q ² > 0: predictive relevance Q ² < 0: lack of predictive relevance 0.02 (small), 0.15 (moderate), 0.35 (strong)	Q ² OSH Implementation 0.857>0 Q ² Safety culture 0.860>0	Fit

Source: Data Processing, 2025

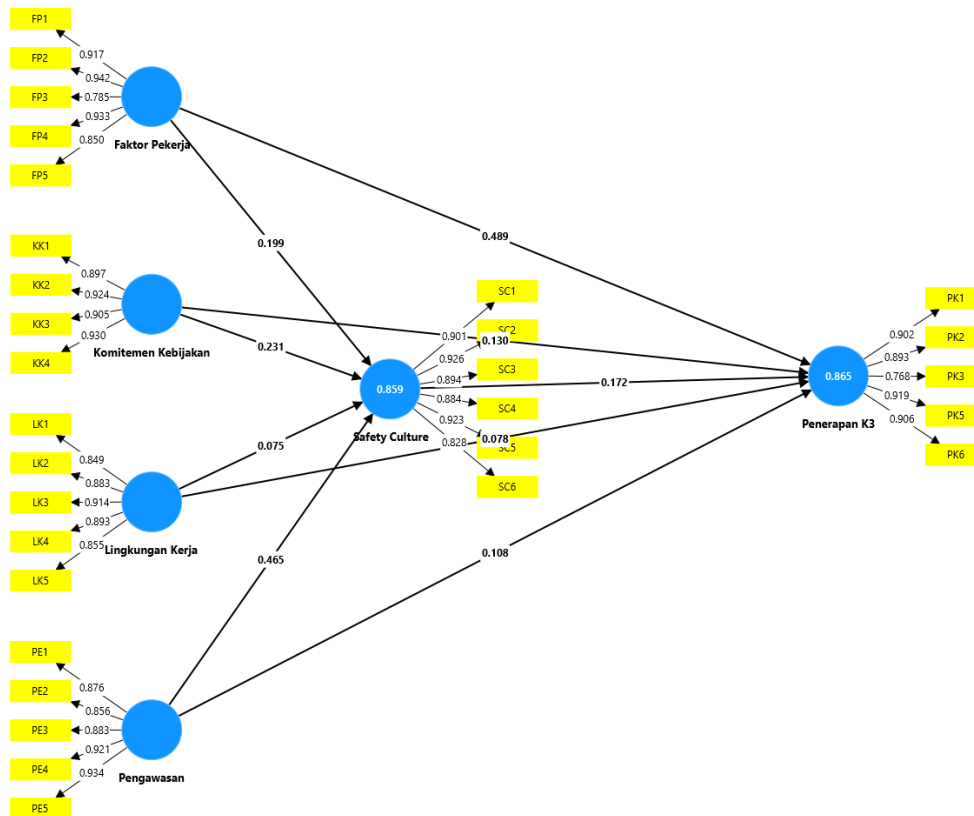


Figure 1. PLS-SEM Algorithm Output

About Safety Culture, the most significant influence was exerted by Supervision ($\beta = 0.465$), followed by Policy Commitment ($\beta = 0.231$) and Worker Factors ($\beta = 0.199$). Meanwhile, the Workplace Environment contributed only marginally ($\beta = 0.075$). These findings reinforce the notion that active supervisory involvement and leadership commitment play crucial roles in shaping

safety values in the workplace (9)(10). Thus, the model indicates a significant indirect effect, particularly from supervision and policy commitment to OSH implementation through the mediation of safety culture. This aligns with safety climate theory, which emphasizes that safety culture is the key pathway through which organizational

factors influence safe behavior in the field (9).

Discussion

The results of this study show that worker factors have a positive and significant effect on OSH implementation. Compliance with work procedures (FP2) was the indicator with the highest contribution, while OSH knowledge (FP3) was the lowest. This finding supports the view of Ghofur et al. that sustainable safety behavior requires a strong foundation of knowledge (10). Although workers are disciplined in following SOPs, a lack of technical understanding may limit the effectiveness of OSH implementation. Continuous training programs should be enhanced to strengthen risk comprehension and control techniques.

Worker factors were also found to influence safety culture. Discipline in adhering to procedures serves as the pillar of a safety culture, while OSH knowledge again emerged as the weakest aspect. This indicates that forming a safety culture requires a combination of expertise and positive worker attitudes (9). Participatory interventions such as mentoring or coaching can strengthen the internalization

of safety values. Participatory interventions such as mentoring or coaching can strengthen the internalization of safety values.

Although the measurement model demonstrated good convergent and discriminant validity, potential construct overlap between worker factors and safety culture cannot be fully ruled out. Both constructs share conceptual proximity, particularly in aspects such as compliance and behavioral discipline. This overlap may partially explain why some variables, such as policy commitment or supervision, did not show significant direct effects on OHS implementation. While multicollinearity tests in PLS-SEM indicated acceptable levels, future studies may benefit from refining the operationalization of worker factors and safety culture to ensure clearer distinction and reduce redundancy. This would allow for a more precise evaluation of how individual and organizational dimensions interact in shaping OHS performance.

Policy commitment significantly affected safety culture, particularly through leadership participation (KK4). This finding aligns with Saputri, who emphasizes the importance of management

role models in shaping safety values. The relatively low score on safety priority (KK1) indicates the need for integrating safety into strategic decision-making so that workers tangibly experience the value (11).

Supervision played a strong role in shaping safety culture, primarily through direct feedback (PE5). However, weak enforcement of sanctions (PE2) may undermine long-term compliance. Consistent with Amin et al. adequate supervision must be proactive, enforce rules consistently, and provide constructive feedback (7).

The non-significant direct effects of policy commitment, workplace environment, and supervision on OSH implementation indicate that these variables influence OSH more indirectly through safety culture. This finding is consistent with Reason's Swiss Cheese model (12), in which organizational elements affect safe behavior through the layers of culture and risk perception.

CONCLUSION AND RECOMMENDATION

This study highlights the central role of worker-related factors in OSH implementation and safety culture at

Refinery Unit (RU) VI Balongan. Policy commitment and supervision significantly influence safety culture but not OSH implementation, while the workplace environment shows minimal impact. Worker factors, particularly procedural compliance, are the main drivers of effective OSH, though limited knowledge remains a weakness. Safety culture emerges as the key mediating mechanism linking organizational factors to safe behavior. Strengthening OSH requires continuous worker training on risk and hazard control, embedding safety values in decision-making, and ensuring proactive, consistent supervision supported by enforcement, with strategies prioritizing the development of a strong safety culture.

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