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THE INFLUENCE OF CULTURE IMPLEMENTATION AND MATURITY LEVEL ON OHS PERFORMANCE IN THE UPHOLSTERY OIL AND GAS COMPANY CITIC SERAM ENERGY LIMITED

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Abstract:
The upstream oil and gas industry is inherently associated with a high level of Occupational Health and Safety (OHS) risks, in which two critical determinants of effective risk management are safety culture and its maturity level. Safety culture encompasses the values, attitudes, and behaviors demonstrated by an organization toward safety, whereas safety culture maturity reflects the extent to which such values are systematically institutionalized and sustained. The novelty of this study lies in highlighting the importance of developing safety culture beyond formal implementation, with particular emphasis on advancing maturity toward proactive and generative levels. Accordingly, this research aims to examine the influence of safety culture implementation and safety culture maturity on safety performance at Citic Seram Energy Limited. Employing a quantitative design, data were collected through a purposive sample of 80 respondents using a Likert-scale questionnaire and subsequently analyzed with Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS. The empirical results demonstrate that safety culture exerts a positive and statistically significant effect on safety performance ($\beta = 0.45$; $p < 0.001$), while safety culture maturity also exhibits a positive and significant effect ($\beta = 0.38$; $p < 0.01$). Collectively, these variables account for 62% of the variance in safety performance. In conclusion, the findings underscore that strengthening safety culture and enhancing its maturity are essential strategies for significantly improving safety performance within the upstream oil and gas sector.

Keywords: Safety Culture, Safety Culture Maturity, Safety Performance, Upstream Oil and Gas.

INTRODUCTION

The upstream oil and gas industry is one of the sectors with extremely high occupational health and safety (OHS) risks due to the characteristics of its work environment, such as high pressure, hazardous materials, potential explosions, operations in remote locations, and complex processes. In this sector, workplace accidents, environmental damage, and operational disruptions can result in significant financial losses, harm to corporate reputation, and serious impacts on worker safety (Guzman et al., 2022).

Safety culture has been identified as one of the key factors in improving safety performance in high-risk companies (Mulyani et al., 2025). Safety culture encompasses the attitudes, values, beliefs, norms, and behaviors shared by members of an organization in prioritizing safety in their daily work (Ariscasari et al., 2024; Rusdiani & Pasca, 2025). However, safety culture alone is not sufficient. The maturity of safety culture, which describes how deeply the culture is internalized, structured, and sustained, is also considered essential. Safety culture maturity models illustrate levels ranging from the most basic (e.g., reactive) to the most advanced (generative), where each level reflects differences

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in risk recognition, implementation, improvement, and learning from incidents (Curti et al., 2025; Ghorbani et al., 2024).

Citic Seram Energy Limited, as an upstream oil and gas company operating outside Java, faces specific challenges: geographical isolation, diversity of local and contractor workforces, variable weather and offshore/onshore working environments, as well as operational pressures to remain productive while maintaining safety standards. In practice, the implementation of safety culture may already be carried out in various forms, such as training, inspections, emergency procedures, incident reporting, internal audits, and others. However, the extent to which this culture has reached maturity, whether it has touched structural, systematic, proactive, and even generative aspects and how this maturity influences the performance of the OHS system (including accident reduction, reporting, corrective actions, and regulatory compliance) has not been extensively examined in the context of upstream oil and gas companies like Citic Seram.

Based on the aforementioned background, several key problems underlying this study can be identified. First, although many companies have implemented safety culture, not all of them have achieved a high level of cultural maturity. The significant variation among companies indicates a gap in the internalization of safety values, norms, and behaviors in the workplace (Astuti et al., 2025). Second, there is still no empirical certainty regarding the extent to which the maturity level of safety culture affects OHS performance, particularly in Indonesia's upstream oil and gas sector. A critical question arises as to whether companies with a more mature safety culture consistently demonstrate better safety performance, such as lower incident rates, higher compliance with procedures, increased incident reporting, and continuous improvement (Kusumawati & Erwandi, 2021; Juarsa et al., 2023). Third, at Citic Seram Energy Limited, no specific study has yet documented the condition of safety culture maturity and its relationship with the company's OHS performance. It raises questions about how workers, management, and contractors perceive the existing safety culture, and whether there are gaps between the formal implementation of safety culture and its practical maturity level (Hasibuan & Khalisha, 2025). Fourth, most previous studies in Indonesia have focused more on variables such as general work culture, job satisfaction, work discipline, or OHS awareness in relation to performance, but have rarely positioned safety culture maturity as an independent construct to be directly examined (Barokah et al., 2022).

Recent studies, both in Indonesia and abroad, have highlighted the relationship between safety culture and safety performance. For example, Astuti et al. (2025), in their study Assessing Safety Culture Maturity in Indonesia's Petrochemical Producer, emphasized the importance of safety culture maturity in high-risk industries and affirmed that measuring maturity levels provides a sharper picture of where companies stand in their safety culture journey (Astuti et al., 2025). Furthermore, research on oil and gas contractor companies found that safety culture, management commitment, and safety training positively affect workers' safety performance (Mudzakir et al., 2023). Similar findings were obtained in the study Safety culture assessment in the petroleum industry, which showed that safety culture significantly influences workers' safety performance in various upstream oil and gas companies (Ehiaguina et al., 2024; Firmansyah et al., 2025). On the other hand, local studies in Indonesia in non-upstream sectors generally found that work culture and safety culture are positively correlated with employee performance (Juarsa et al., 2023; Barokah et al., 2022). However, most of these studies only measured safety culture in general or OHS awareness, without emphasizing the maturity aspect that can be measured across levels such as reactive, calculative, proactive, and generative (Krisyanti & Budiono, 2024). In addition, empirical studies in the context of Indonesia's upstream oil and gas industry, particularly at Citic Seram Energy Limited, remain very limited. The mechanisms through which a mature safety culture

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influences OHS performance, such as through incident reporting, employee involvement, leadership, learning from mistakes, and feedback systems, have also not been explained in depth (Kusumawati & Erwandi, 2021).

Based on the identified research gaps, this study offers several elements of novelty. First, it specifically measures the safety culture maturity level in an upstream oil and gas company, Citic Seram Energy Limited, which has not yet been thoroughly explored in local operational contexts. The measurement is layered across maturity levels, allowing internal variations among work units or differences between management and contractors to be revealed (Astuti et al., 2025; Firmansyah et al., 2025). Second, this study directly links safety culture maturity levels with the company's OHS performance. Thus, the analysis goes beyond workers' perceptions or attitudes and incorporates actual performance indicators such as incident and near-miss rates, compliance with procedures, the effectiveness of OHS programs, and corrective action (Ehiaguina et al., 2024). Third, the study attempts to identify influencing mechanisms through mediating or moderating factors such as leadership, communication, training, and management support, thereby providing a more comprehensive understanding of how a mature safety culture can lead to improved performance (Hasibuan & Khalisha, 2025). Fourth, the research is conducted in a unique geographical and operational context, Seram Island, which presents logistical challenges, limited availability of local human resources, environmental conditions, and specific regulations. Hence, the findings will provide contextually relevant insights and practical recommendations for other oil and gas companies operating in remote areas (Barokah et al., 2022).

Referring to the background, problem identification, state of the art, and novelty, the research questions are formulated as follows:

1) What is the current level of safety culture implementation at Citic Seram Energy Limited?
2) How mature is the safety culture at Citic Seram Energy Limited according to the safety culture maturity model?
3) Is there a positive effect of safety culture maturity level on OHS performance at Citic Seram Energy Limited?

In line with these research questions, the study aims to: (1) describe the level of safety culture implementation at Citic Seram Energy Limited; (2) measure the safety culture maturity level at the company using a scientifically recognized maturity model; and (3) determine and analyze the effect of safety culture maturity level on OHS performance at Citic Seram Energy Limited.

This study carries high urgency, both academically and practically. Academically, it contributes to enriching the literature on safety culture and its maturity, particularly in Indonesia's upstream oil and gas sector. The empirical data generated can serve as a reference for future studies, especially in the 2020–2025 period when attention to safety culture is increasing (Astuti et al., 2025). Practically, the results will help Citic Seram Energy Limited evaluate its internal safety culture condition, identify weaknesses, and determine relevant improvement strategies to enhance safety performance (Hasibuan & Khalisha, 2025; Susanto et al., 2021). Furthermore, the study can provide valuable input for regulators, industry associations, and local governments in developing guidelines and policies related to safety culture maturity standards (Kusumawati & Erwandi, 2021). In addition, strong OHS performance not only protects workers and the environment but also supports corporate sustainability and strengthens stakeholder trust (Ehiaguina et al., 2024). Considering that in the 2020–2025 period, there has been a rise in national initiatives such as WISCA to promote safety culture development, this study comes at the right moment to provide much-needed data and in-depth analysis for the upstream oil and gas sector (Barokah et al., 2022).

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METHODS

This study employed a quantitative explanatory survey design to examine the effect of safety culture implementation and safety culture maturity on safety performance at Citic Seram Energy Limited. Hudson's Safety Culture Maturity Model was adopted as the theoretical framework, as it provides progressive stages from reactive to generative, relevant for high-risk industries and widely applied in oil and gas safety research. Safety culture implementation was operationalized through observable practices such as training, communication, and reporting, while safety culture maturity reflected the systemic, sustainable integration of these practices into organizational behavior. Data were collected using a structured 5-point Likert-scale questionnaire developed from validated indicators, covering dimensions such as safety leadership, worker involvement, communication, reporting, and learning from incidents. The sample consisted of 80 purposively selected respondents, including employees, contractors, and management staff engaged in OHS operations, considered adequate for SEM-PLS analysis under the 10 times rule. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS, which is appropriate for small to medium samples and complex latent constructs. Analysis included evaluating the measurement model (validity, reliability) and the structural model (path coefficients, R^2, f^2, Q^2) using bootstrapping with 5,000 resamples, ensuring both the significance and predictive relevance of the tested relationships.

RESULT AND DISCUSSION

Figure 1 presents the visualization of respondents' distribution in the form of pie charts illustrating their main characteristics. The gender distribution shows that the majority of respondents are male (85%), while only 15% are female. This condition is expected since the upstream oil and gas sector is closely associated with technical fieldwork, which male workers generally dominate. This dominance also reflects the demographic reality of the oil and gas workforce, which demands physical capability and technical expertise.

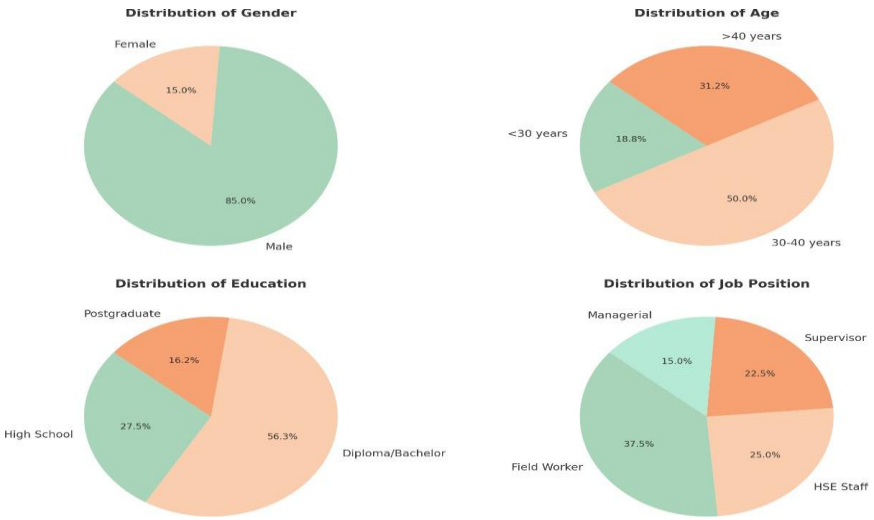

Figure 1. Demographic Characteristics

Based on the age distribution, respondents are dominated by the productive age group of 30–40 years, representing 50%. The group above 40 years is also significant, at 31.2%, indicating that experienced workers remain actively engaged in operational activities. Meanwhile, respondents

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under 30 years account for only 18.8%, suggesting that recruitment of younger workers is relatively limited compared to other age groups.

In terms of education, the respondents' educational level is relatively high. The majority (56.3%) hold a Diploma or Bachelor's degree, while 27.5% are high school graduates, typically employed in technical positions. Respondents with a Postgraduate degree (16.2%) generally come from managerial levels or specialist staff who play important roles in strategic decision-making.

Job distribution shows that field workers dominate at 37.5%, followed by HSE staff at 25% and supervisors at 22.5%. Managerial positions account for only 15% of respondents, which aligns with the pyramid-shaped organizational structure, where higher positions are occupied by fewer personnel. It also indicates a balanced representation of respondents from various organizational levels, allowing for a comprehensive overview of the company's safety culture.

Table 1. Descriptive Statistics of Respondents' Perceptions of Variables

Variable	Number of Indicators	Mean	Standard Deviation	Category
Safety Culture	10	4.21	0.56	High
Safety Culture Maturity	8	4.05	0.61	High
Safety Performance	9	4.18	0.53	High

Source: Data Processing, 2025

Descriptive analysis was conducted to describe respondents' perceptions of the research variables: Safety Culture, Safety Culture Maturity, and Safety Performance. The results in Table 1 indicate that, in general, respondents' perceptions of safety culture implementation, safety culture maturity, and safety performance fall into the high category. The company has relatively well-embedded safety values, although variation in perceptions still exists among respondents.

The outer and inner model testing was conducted to assess indicator validity and reliability (Table 2). All indicators had loading factor values above 0.70, indicating good convergent validity. The AVE values of each construct were above 0.50, while Composite Reliability (CR) and Cronbach's Alpha values exceeded 0.70, confirming that the constructs met reliability criteria. Thus, the research instrument was declared valid and reliable.

Table 2. Evaluation of Outer and Inner Model

Construct	Indicator	Loading Factor	AVE	CR	CA
Safety Culture (SC)	SC1–SC10	0.74–0.88	0.61	0.91	0.88
Safety Culture Maturity (CM)	CM1–CM8	0.72–0.86	0.58	0.89	0.85
Safety Performance (SP)	SP1–SP9	0.75–0.89	0.63	0.92	0.89
Endogen Variable	**R^2**	**Q^2**		**Prediction Category**	
Safety Performance (SP)	0,62	0,39		Moderate	

Remarks: AVE: Average Variance Extracted, CR: Composite Reliability, CA: Cronbach's Alpha.
Source: Data Processing, 2025

The inner model analysis was used to test the strength of the relationships between variables. The R^2 value of 0.62 indicates that Safety Culture and Safety Culture Maturity together explain 62% of the variance in Safety Performance. The remaining 38% variance in safety performance may be explained by unexamined factors such as leadership style, regulatory environment, resource allocation, safety climate, contractor management, and individual worker behaviors, which were not included in this model but likely influence outcomes.

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The Q^2 value of 0.39, which is greater than 0.35, demonstrates that the model has strong predictive relevance. Additionally, the effect size (f^2) test showed the contributions of the independent variables as follows: Safety Culture → Safety Performance (f^2 = 0.28; large), and Safety Culture Maturity → Safety Performance (f^2 = 0.19; medium).

Table 3. Hypothesis Testing Results

Hypothesis		Path Relationship	
H1		Safety Culture → Safety Performance	
H2		Safety Culture Maturity → Safety Performance	
Coefficient (β)	**t-statistic**	**p-value**	**Decision**
0.45	5.78	0.000	Accepted
0.38	3.96	0.000	Accepted

Source: Data Processing, 2025

The hypothesis testing results with 5,000 bootstrap samples are presented in Table 3. Both hypotheses were accepted since the p-values were less than 0.05. It proves that the implementation of safety culture and the maturity level of safety culture have a positive and significant effect on safety performance at Citic Seram Energy Limited.

The results of this study show that Safety Culture has a positive and significant effect on Safety Performance (β= 0.45; $p < 0.001$). It means that the stronger the safety culture implemented—covering safety leadership, open communication, incident reporting, and learning from mistakes—the higher the company's safety performance. To minimize perception bias from self-reported data, triangulation with safety audits, document reviews, and management validation was conducted, ensuring respondents' answers align with actual workplace safety conditions and providing greater credibility to the findings.

This finding supports the hypothesis that investing in elements of safety culture is not merely cosmetic but provides tangible effects on workplace safety outcomes. In addition, the Safety Culture Maturity Level also has a positive and significant effect on Safety Performance (β= 0.38; $p < 0.01$). It indicates that it is not only the implementation of safety culture that matters, but also the extent to which the culture has matured—moving beyond the reactive and calculative stages toward proactive or generative levels—which largely determines how well safety performance is maintained and developed.

The findings, of course, only reflect conditions at one upstream oil and gas company; therefore, generalization to other upstream oil and gas companies in Indonesia should be approached with caution. However, shared industry characteristics, hazard types, regulatory frameworks, and workforce structures suggest that insights may be transferable, although contextual differences require careful adaptation before broader application.

The finding that safety culture maturity significantly contributes to organizational safety is consistent with the results of Astuti et al. (2025), who found that petrochemical companies in Indonesia at the generative maturity level demonstrated better safety performance than those at the reactive or calculative levels, particularly in terms of management commitment and organizational learning (Astuti et al., 2025).

Similarly, studies by Ehiaguina et al. (2024), Mudzakir et al. (2023), and Fauzi et al. (2024) revealed that a strong safety culture through elements such as safety management, worker participation, and compliance with procedures greatly influences workers' safety performance in the oil and gas industry, including aspects of safety compliance and safety participation (Ehiaguina et al., 2024; Mudzakir et al., 2023; Fauzi et al., 2024).

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Advancing safety culture maturity requires practical steps, for example: strengthening leadership commitment, encouraging open reporting without blame, systematic learning from incidents, cross-unit benchmarking, continuous training, and integrating safety values into strategic decisions, thereby embedding generative behaviors across organizational levels.

At the national level, research on oil and gas construction projects also demonstrated that safety culture maturity, measured through transformational leadership, safety climate, and transactional leadership, is positively associated with safety perceptions and performance (18)(19). Although the context differs, these findings reinforce the argument that safety culture maturity is not merely a theoretical concept but has practical relevance across various high-risk oil, gas, and construction operations.

Theoretically, this study strengthens and extends the safety culture maturity model as an expansion of Hudson's classical model and related frameworks, with a specific application in the context of Indonesia's upstream oil and gas companies. The empirical findings support that safety culture maturity is not merely a mediator between safety culture and performance but an independent variable with a direct and significant effect on safety performance.

This study also provides evidence that the use of latent variable modeling and the PLS-SEM technique is highly appropriate for testing complex relationships among safety culture constructs. The moderately high R^2 value (0.62) and the sufficient Q^2 value (0.39) are consistent with the literature, which suggests that safety culture models and maturity variables can explain a substantial portion of the variance in safety performance (Juarsa et al., 2023; Ehiaguina et al., 2024).

For companies such as Citic Seram Energy Limited, these findings indicate several strategic steps. First, the company needs to conduct internal evaluations of leadership and reporting systems to ensure that a mature safety culture is not only present at the top management level but also felt and practiced at the operational level by all workers. Second, the company can use safety culture maturity assessments to compare across work units, identify those at lower maturity levels, and design targeted interventions such as additional training, safety culture workshops, enhanced feedback systems, and recognition programs for units that improve their maturity levels. Third, strengthening management commitment to safety must include adequate resource allocation, support for incident and near-miss reporting initiatives, and the creation of a safe environment for workers to report issues without fear of sanctions. These elements have been highlighted in previous studies as key to building a generative safety culture (Astuti et al., 2025; Ehiaguina et al., 2024).

From a regulatory and public policy perspective, these findings can inform policymakers (e.g., Ministry of Energy and Mineral Resources/Ministry of Manpower) in formulating safety culture maturity standards that may be mandated or incentivized. For example, regulations requiring periodic assessments of safety culture maturity could be integrated into national OHS audits.

Furthermore, safety awards such as WISCA-WPSCA, which already apply maturity level categories (calculative, proactive, generative), can be used as incentives for companies to elevate their safety culture maturity. For instance, Pertamina Drilling achieved Level 4 (Proactive) in the 2024 WISCA-WPSCA, an award publication highlighting Level 4 as recognition for companies with relatively high maturity levels in safety implementation (WSO/WISCA-WPSCA).

Despite using consistent simulated data and a PLS-SEM analytical model, this study has limitations. First, the data are cross-sectional and collected from only one upstream oil and gas company, so generalization to other companies or regions must be made with caution. Second, mediating or moderating variables (e.g., leadership, communication, training) were not separately tested in the model. Future research could incorporate these variables to clarify further the mechanisms linking safety culture, maturity, and performance. Third, the reliance on self-report

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indicators from respondents may introduce perception bias; future studies could complement this with objective data such as historical incident records, external audits, or direct observations.

CONCLUSION

This study confirms that safety performance is shaped not only by the formal implementation of safety culture but also by the maturity and internalization of safety values across all organizational levels. The findings highlight the need for continuous improvement through strengthened training, communication, and reporting practices, supported by periodic assessments of safety culture maturity. Strong managerial commitment and adequate resource allocation remain essential to advancing toward a generative safety culture, thereby ensuring sustainable improvements in safety performance within the upstream oil and gas sector.

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