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Analysis of Factors Influencing Employee Compliance with Corporate Life Saving Rules (CLSR) Using the Partial Least Squares Structural Equation Modeling (PLS-SEM) Approach in the Upstream Oil and Gas Industry

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Corporate Life Saving Rules (CLSR); Safety Compliance; Safety Climate; Safety Knowledge; Partial Least Squares Structural Equation Modeling (PLS-SEM).

ABSTRACT

This study aimed to analyze the effects of individual, organizational, and work environment factors on employee safety compliance in the implementation of Corporate Life Saving Rules (CLSR) and to formulate strategic recommendations for improving implementation effectiveness. The study employed a quantitative approach using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method. Data were collected through questionnaires distributed to 174 workers and work partners involved in high-risk activities. The results indicated that Safety Climate, Safety Knowledge, and Safety Motivation had positive and significant effects on Safety Compliance in CLSR implementation. Safety Leadership did not directly affect Safety Compliance but played an important role in enhancing Safety Motivation, Risk Perception, and Safety Knowledge, which support safe work behavior. In addition, Workload and Work Schedule were found to have negative effects on Safety Motivation. This study concluded that improving worker compliance with CLSR requires an integrated approach involving the strengthening of safety climate, enhancement of safety knowledge, development of safety leadership, and management of work environment factors that influence workers' motivation to engage in safe behaviors. These findings contribute theoretically to the development of safety compliance models in the upstream oil and gas industry and provide a foundation for developing strategies to improve CLSR implementation in support of achieving the Zero Fatality target.

INTRODUCTION

The upstream oil and gas industry is one of the industrial sectors with a high level of occupational safety risk due to its involvement in various activities with the potential to cause Serious Injury and Fatality (SIF), including lifting operations, hot work, confined space entry, work at height, energy isolation, and line-of-fire hazards (Rahim, Dapari, Che Dom, & Mohd Noor, 2024). Despite continuous technological advancements and improvements in safety management systems, fatal workplace accidents remain a significant challenge for the oil and gas industry worldwide. Data from the International Association of Oil & Gas Producers (IOGP) indicate that, in 2024, there were 32 fatalities in the global upstream oil and gas industry, increasing from 27 cases in the previous year. This condition demonstrates that fatality prevention efforts still require serious attention, particularly for high-risk activities that remain the dominant contributors to workplace accidents (Palendeng & Bernarto, 2022).

To reduce the potential for fatalities, the IOGP developed Life Saving Rules (LSR), which consist of fundamental safety requirements designed to control high-risk activities (IOGP, 2024). Referring to these guidelines, PT Pertamina Hulu Energi implemented Corporate Life Saving Rules (CLSR) as a company-wide safety standard aimed at improving worker compliance with safe work practices and supporting the achievement of the Zero Fatality target (Ansong, Amadu, & Ahomka Yeboah, 2025). However, the effectiveness of CLSR implementation depends not only on the availability of safety procedures but also on workers' ability and willingness to consistently apply these rules during operational activities (Pradewa & Mahardayani, 2023).

Despite the comprehensive implementation of CLSR, safety performance data indicate that violations of these requirements remain among the leading causes of workplace incidents (Masudin, Tsamarah, Restuputri, Trireksani, & Djajadikerta, 2024). Internal data from PT Pertamina Hulu Energi in 2024 show that violations were still dominated by line-of-fire incidents, tools and equipment-related issues, and lifting operations, all of which are activities regulated under CLSR. This condition indicates a persistent gap between established safety policies and actual worker compliance behavior in the field. Therefore, a comprehensive understanding of the factors influencing worker compliance with CLSR is required to develop more effective safety improvement strategies (Guzman, Recoco, Pandi, Padrones, & Ignacio, 2022).

Previous academic studies have demonstrated that compliance with safety regulations is influenced not only by formal rules and control systems but also by multidimensional factors involving individual, organizational, and work environment perspectives. From the individual perspective, Safety Knowledge has been shown to improve safety behavior by enhancing workers' understanding of safe work procedures (Saedi, Ab. Majid, & Isa, 2020), while Safety Motivation functions as a mechanism that encourages compliance with safety procedures (Wang, Mao, Zhao, Wang, & Hu, 2023). Furthermore, individual characteristics influence safety behavior by strengthening workers' motivation and awareness of safe work practices (Albalá-Genol, Díaz-Fúnez, Martín-Martín, & Mañas-Rodríguez, 2024). From an organizational perspective, Safety Leadership contributes to the development of safety culture through management commitment, leadership role modeling, and effective safety communication (Won, Choi, & Kim, 2024), while Safety Climate enhances compliance with work procedures through positive worker perceptions of organizational safety policies and practices (Bensonch, Argyropoulos, Dimopoulos, Varianou Mikellidou, & Boustras, 2022). From a work environment perspective, inadequate work schedules may increase worker fatigue and reduce compliance with safety procedures (Truman & Dewi, 2024). Similarly, excessive workload may affect workers' physical and psychological conditions, thereby increasing the likelihood of unsafe behavior (Kusmawan, Izhar, & Aswin, 2024). However, most previous studies have examined these factors separately, providing limited understanding of the integrated relationships among individual, organizational, and work environment factors in influencing safety compliance with Corporate Life Saving Rules (CLSR) within the Indonesian upstream oil and gas industry (Mathisen, Tjora, & Bergh, 2022).

The urgency of this research is supported by the persistent gap between CLSR implementation and worker compliance behavior, as reflected in continuing safety violations and incidents within the upstream oil and gas industry. The increasing complexity of high-risk

operations and the industry's commitment to achieving the Zero Fatality target require a deeper understanding of the factors influencing employee safety behavior. By identifying dominant factors and their mechanisms of influence, this study aims to provide evidence-based recommendations for improving CLSR effectiveness. This research contributes to the development of a safety compliance model specifically adapted to the Indonesian upstream oil and gas context and provides practical insights for organizations seeking to strengthen safety culture and reduce workplace fatalities.

Based on these conditions, this study developed a conceptual model integrating individual, organizational, and work environment factors to examine factors influencing safety compliance in the implementation of Corporate Life Saving Rules (CLSR). The analysis was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach because this method enables the simultaneous examination of relationships among latent variables, including direct and indirect effects, making it appropriate for analyzing complex research models. This approach is expected to provide a comprehensive understanding of the mechanisms underlying worker compliance with CLSR.

METHOD

Research Design

This study employed a quantitative approach with a cross-sectional research design, in which data were collected at a single point in time to examine the relationships among variables in the research model. This approach was selected to analyze the effects of individual, organizational, and work environment factors on Safety Compliance in the implementation of Corporate Life Saving Rules (CLSR) within the upstream oil and gas industry.

The relationships among variables were analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method. This method was selected because it is suitable for examining complex relationships among latent variables and analyzing models involving multiple exogenous and endogenous constructs. Data processing was conducted using SmartPLS 4.0 software.

Location, Population, and Sample

The study was conducted at one of PT Pertamina Hulu Energi's work areas in South Sumatra. The research subjects were workers and partners directly involved in high-risk operational activities within the scope of the Corporate Life Saving Rules (CLSR) implementation. The study population comprised all workers and partners who met the research criteria. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in a minimum requirement of 148 respondents. The sampling technique used proportionate stratified random sampling to ensure that each work function received a proportion of respondents corresponding to their respective population size. Data collection was carried out by distributing questionnaires directly to respondents who met the research criteria.

Research Variables and Instruments

This study develops a conceptual model consisting of eight latent constructs, namely Safety Leadership (SL), Safety Climate (SC), Safety Knowledge (SK), Risk Perception (RP), Safety Motivation (SM), Workload (WL), Work Schedule (WS) and Safety Compliance (SCM). Safety Leadership, Safety Climate, Workload and Work Schedule are positioned as

exogenous variables, while Safety Knowledge, Risk Perception and Safety Motivation act as mediating variables that influence Safety Compliance as an endogenous variable.

The research instrument was developed by adapting indicators from various previous studies relevant to each research construct, then adapting them to the characteristics of the upstream oil and gas industry and the implementation of Corporate Life Saving Rules (CLSR). All indicators were measured using a five-level Likert scale, with a score range of 1 (strongly disagree) to 5 (strongly agree). A summary of the number of indicators and questionnaire items used for each variable is presented in Table 1.

Table 1. Summary of Research Variables and Instruments

Variables	Variable Types	Amount Indicator	Amount Question
Safety Knowledge	Mediator	4	8
Risk Perception	Mediator	4	4
Safety Motivation	Mediator	3	7
Safety Leadership	Exogenous	4	8
Safety Climate	Exogenous	5	7
Workload	Exogenous	3	4
Work Schedule	Exogenous	2	4
Safety Compliance	Endogen	5	6
Total		**30**	**48**

Based on theoretical studies and previous research, this study develops a conceptual model that describes the direct and indirect relationships between organizational factors, individual factors, and work environment factors on Safety Compliance in the implementation of Corporate Life Saving Rules (CLSR). The conceptual model consists of fifteen hypotheses that connect each research variable, as shown in Figure 1.

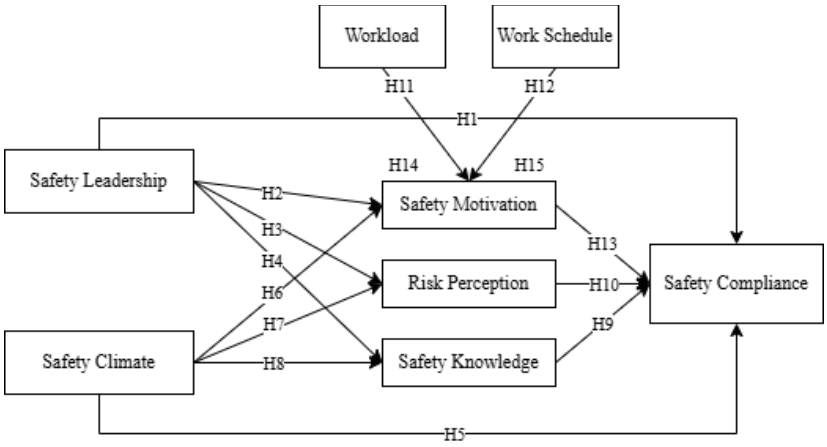

Figure 1. Conceptual Research Model

The conceptual model shows that Safety Leadership and Safety Climate as organizational factors are hypothesized to directly influence Safety Knowledge, Risk Perception, Safety Motivation, and Safety Compliance. Furthermore, Workload and Work Schedule as work environment factors are hypothesized to influence Safety Motivation, while Safety Knowledge,

Risk Perception, and Safety Motivation are positioned as mediating variables that influence Safety Compliance. In addition to the direct relationship between variables, this study also examines the mediating role of Safety Motivation in the relationship between Workload and Work Schedule on Safety Compliance. Furthermore, the conceptual model is analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach to evaluate the measurement model and structural model, and to test the formulated research hypotheses.

Data Analysis Techniques

Data analysis was conducted using the PLS-SEM approach consisting of two stages: measurement model evaluation (outer model) and structural model evaluation (inner model). The outer model evaluation aims to test the quality of the research instrument through convergent validity, discriminant validity, and construct reliability testing. Convergent validity was evaluated based on the outer loading value and Average Variance Extracted (AVE), while discriminant validity was evaluated using the Heterotrait-Monotrait Ratio (HTMT). Construct reliability was assessed based on Cronbach's Alpha and Composite Reliability. Furthermore, the inner model was evaluated using the Coefficient of Determination (R^2), Effect Size (f^2), and Predictive Relevance (Q^2) values to assess the model's predictive ability. Hypothesis testing was conducted through a bootstrapping procedure with 5,000 subsamples, using the path coefficient, t-statistic, and p-value as the basis for decision-making regarding the research hypothesis. The hypothesis is declared accepted if the p-value is <0.05 at the 95% confidence level and the t-statistic is ≥ 1.645 (one-tailed test).

RESULTS AND DISCUSSION

Respondent Characteristics

This study involved 174 respondents, consisting of workers and business partners involved in high-risk operational activities. Respondent characteristics were analyzed based on department, age, length of service, employment status, and education level to provide a profile of the respondents who were the subjects of the study.

Table 2. Respondent Characteristics

Respondent Characteristics	Classification	Frequency	Percentage
Department	Production	47	27%
	Maintenance	19	11%
	Technical Service	59	34%
	Well Intervention	49	28%
Age	≤ 27 Years	31	18%
	28–35 Years	41	24%
	36–45 Years	45	26%
	≥ 46 Years	57	33%
Length of work	1–5 Years	75	43%
	6–10 Years	31	18%
	> 10 Years	68	39%
Worker Status	Work partners	146	84%
	Worker	28	16%

Respondent Characteristics	Classification	Frequency	Percentage
Level of education	High School / Vocational School / Equivalent	115	66%
	Diploma (D3/D4)	18	10%
	Bachelor degree)	37	21%
	Postgraduate (S2/S3)	4	2%

Based on Table 2, respondents were dominated by workers from the Technical Service function (34%), followed by Well Intervention (28%), Production (27%), and Maintenance (11%). This composition indicates that respondents came from various operational functions directly involved in high-risk work and are therefore considered capable of representing the implementation of Corporate Life Saving Rules (CLSR) in the workplace. Based on individual characteristics, the majority of respondents were aged ≥46 years (33%), had worked for 1–5 years (43%), were partners (84%), and were predominantly high school/vocational high school graduates (66%). These characteristics indicate that most respondents were field workers with operational experience and direct exposure to high-risk activities. Therefore, respondents were deemed to have an adequate understanding of CLSR implementation, thus providing a representative perception of the factors influencing Safety Compliance in the upstream oil and gas industry.

Descriptive Statistical Analysis

Descriptive statistical analysis was conducted to provide an overview of respondents' perceptions of all study variables. The analysis was conducted based on the average (mean) value of each variable obtained from respondents' answers using a five-point Likert scale. The results of this analysis provide an initial overview of the implementation of Corporate Life Saving Rules (CLSR) before testing the relationships between variables using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach.

Table 3. Descriptive Statistics of Research Variables

Variables	*Mean*	Category
Safety Knowledge	4.56	Very high
Risk Perception	4.63	Very high
Safety Motivation	4.59	Very high
Safety Leadership	4.60	Very high
Safety Climate	4.57	Very high
Workload	3.81	Tall
Work Schedule	3.36	Currently
Safety Compliance	4.56	Very high

In general, the descriptive statistics show that respondents have a positive perception of most of the research variables. The Risk Perception variable has the highest average value (4.63), followed by Safety Leadership (4.60), Safety Motivation (4.59), Safety Climate (4.57), Safety Knowledge (4.56), and Safety Compliance (4.56). The high average value indicates that respondents have a good perception of safety leadership, safety climate, safety knowledge, safety motivation, and compliance in implementing Corporate Life Saving Rules (CLSR) in the work environment.

On the other hand, Workload (3.81) and Work Schedule (3.36) had relatively lower average values compared to the other variables. This finding indicates that respondents' perceptions of workload and work schedule management are more diverse than their perceptions of organizational and individual aspects. Nevertheless, both variables still showed average values above the midpoint of the measurement scale, indicating that respondents generally assessed workload and work schedule management conditions as being at a fairly good level.

The high average values for each variable cannot be used to explain the relationship or magnitude of the influence between the variables. Therefore, further analysis was conducted through evaluation of the measurement model (outer model) and structural model (inner model) using the PLS-SEM approach to test the construct validity and causal relationships between the variables proposed in the research hypothesis.

Measurement Model Test Results (Outer Model)

Evaluation of the measurement model (outer model) was conducted to ensure that each research construct met validity and reliability requirements before testing the relationships between variables in the structural model. The evaluation included testing convergent validity, discriminant validity, and construct reliability using outer loading values, Average Variance Extracted (AVE), Cronbach's Alpha, and Composite Reliability.

Table 4. Outer Model Evaluation Results

Variables	*Avg. Outer Loading*	AVE	*Cronbach's Alpha*	*Composite Reliability*	Information
Safety Knowledge	0.814	0.670	0.927	0.941	Valid & Reliable
Risk Perception	0.855	0.730	0.877	0.915	Valid & Reliable
Safety Motivation	0.777	0.611	0.840	0.886	Valid & Reliable
Safety Leadership	0.865	0.749	0.952	0.960	Valid & Reliable
Safety Climate	0.783	0.614	0.895	0.917	Valid & Reliable
Workload	0.715	0.529	0.813	0.813	Valid & Reliable
Work Schedule	0.933	0.874	0.885	0.932	Valid & Reliable
Safety Compliance	0.861	0.742	0.913	0.935	Valid & Reliable

Based on Table 4, all constructs meet convergent validity requirements. All retained indicators had outer loading values ranging from 0.715 to 0.933, thus exceeding the minimum required threshold (≥ 0.60) after eliminating several indicators during the model evaluation stage (Haji-othman, Sholeh, & Yusuff, 2022). Furthermore, the Average Variance Extracted (AVE) values for all constructs ranged from 0.529 to 0.874, thus meeting the convergent validity criteria (AVE ≥ 0.50) as recommended by J.F. Hair et al. (2021). Although the Workload construct had the lowest AVE value (0.529), it was still above the minimum required threshold and was therefore considered valid. The results of the discriminant validity test using the Heterotrait–Monotrait Ratio (HTMT) approach also showed that all constructs met the required criteria (HTMT < 0.90) as recommended by JF Hair et al. (2021), so that each construct was able to represent different concepts from each other.

Furthermore, the reliability test results showed that all constructs had Cronbach's Alpha values ranging from 0.813–0.952 and Composite Reliability values between 0.813–0.960, all of which were above the minimum limit of 0.70 as recommended by J.F. Hair et al. (2021).

These findings indicate that all constructs had a good level of internal consistency. Overall, the results of the measurement model evaluation indicated that all research constructs met validity and reliability requirements and were therefore suitable for use in structural model analysis.

Structural Model Test Results (Inner Model)

Structural model evaluation (inner model) is conducted to assess the model's ability to explain the relationships between latent variables proposed in the study. The evaluation uses the Coefficient of Determination (R^2), Effect Size (f^2), and Predictive Relevance (Q^2) values to measure the explanatory power, contribution of each construct, and the model's predictive ability for endogenous variables.

Table 5. Inner Model Evaluation Results

Variables	R- *Square* (R^2)	Q^2 *predict*	Information
Safety Knowledge	0.570	0.529	Fulfilled
Risk Perception	0.597	0.557	Fulfilled
Safety Motivation	0.597	0.549	Fulfilled
Safety Compliance	0.721	0.643	Fulfilled

Based on Table 5, the Coefficient of Determination (R^2) values for all endogenous variables indicate that the model has good explanatory power. Referring to Hair et al. (2021), R^2 values of 0.25, 0.50, and 0.75 are interpreted as weak, moderate, and substantial, respectively. The Safety Compliance variable obtained an R^2 value of 0.721, indicating that 72.1% of the variation in Safety Compliance can be explained by Safety Leadership, Safety Climate, Safety Knowledge, Risk Perception, and Safety Motivation, while the remaining 27.9% is influenced by other factors outside the research model. Meanwhile, the R^2 values for Safety Knowledge (0.570), Risk Perception (0.597), and Safety Motivation (0.597) are in the moderate category, indicating that the model is able to explain more than half of the variation in each endogenous variable.

The Effect Size (f^2) test results indicate that most of the relationships between variables have a small contribution, while the influence of Safety Climate on Safety Motivation, Risk Perception, and Safety Knowledge is in the medium category. Based on the criteria proposed by Guzman et al. (2020), f^2 values of 0.02, 0.15, and 0.35 indicate a small effect, a medium effect, and a large effect, respectively. This finding indicates that compared to other constructs, Safety Climate provides a relatively larger contribution in explaining changes in mediating variables, thus strengthening its role as a dominant organizational factor in the research model.

Furthermore, the Predictive Relevance (Q^2) evaluation results show that all endogenous variables have Q^2 values greater than zero, ranging from 0.529 to 0.643. Referring to J.F. Hair et al. (2021), a Q^2 value > 0 indicates that the model has good predictive relevance for the endogenous constructs studied. Therefore, the results of this study indicate that the model has adequate predictive ability in explaining the phenomena studied.

Hypothesis Testing

Hypothesis testing was conducted using the bootstrapping method with 5,000 subsamples to evaluate the significance of the relationship between variables in the research model. Testing was conducted based on the path coefficient, t-statistic, and p-value. Referring to J.F. Hair et

al. (2021), a relationship is considered significant if it has a t-statistic > 1.645 and a p-value < 0.05 at the 5% significance level. A relationship that does not meet either of these two criteria is considered insignificant. Therefore, the research hypothesis is accepted if the relationship between variables meets the significance criteria, and rejected if it does not.

Table 6. Hypothesis Testing Results

Variable Relationship	*Original sample* (O)	*T statistics* (|O/STDEV|)	*P values*	*Hypothesis Testing*
Safety Leadership -> Safety Compliance	0.047	0.475	0.317	Rejected
Safety Leadership -> Safety Motivation	0.278	2,045	0.020	Accepted
Safety Leadership -> Risk Perception	0.277	2,037	0.021	Accepted
Safety Leadership -> Safety Knowledge	0.305	2,014	0.022	Accepted
Safety Climate -> Safety Compliance	0.408	3,607	0.000	Accepted
Safety Climate -> Safety Motivation	0.562	3,955	0.000	Accepted
Safety Climate -> Risk Perception	0.529	3,981	0.000	Accepted
Safety Climate -> Safety Knowledge	0.485	3,300	0.000	Accepted
Safety Knowledge -> Safety Compliance	0.240	2,388	0.008	Accepted
Risk Perception -> Safety Compliance	0.065	0.549	0.291	Rejected
Workload -> Safety Motivation	-0.078	1,388	0.083	Rejected
Work Schedule -> Safety Motivation	0.008	0.170	0.432	Rejected
Safety Motivation -> Safety Compliance	0.178	1,853	0.032	Accepted
Workload -> Safety Motivation -> Safety Compliance	-0.014	1,160	0.123	Rejected
Work Schedule -> Safety Motivation -> Safety Compliance	0.001	0.155	0.438	Rejected

Based on Table 6, of the 15 hypotheses proposed, 9 hypotheses were accepted and 6 hypotheses were rejected. Significant relationships include the influence of Safety Leadership on Safety Motivation, Risk Perception, and Safety Knowledge, the influence of Safety Climate on Safety Compliance, Safety Motivation, Risk Perception, and Safety Knowledge, and the influence of Safety Knowledge and Safety Motivation on Safety Compliance. Conversely, the relationship between Safety Leadership on Safety Compliance, Risk Perception on Safety Compliance, Workload on Safety Motivation, Work Schedule on Safety Motivation, and the indirect influence of Workload and Work Schedule on Safety Compliance through Safety Motivation did not show significant results.

The results of the study indicate that Safety Leadership does not have a direct impact on Safety Compliance, but it does significantly influence Safety Knowledge, Risk Perception, and Safety Motivation. Furthermore, although Risk Perception had the highest average value in the

descriptive statistical analysis, this variable was not proven to have a significant effect on Safety Compliance. This finding indicates that high risk perception does not necessarily lead to increased safety compliance behavior.

Overall, the results of the hypothesis testing indicate that organizational and individual factors play a more dominant role in influencing Safety Compliance than work environment factors. Based on these results, the following discussion focuses on interpreting significant and insignificant relationships to explain the mechanisms influencing the implementation of Corporate Life Saving Rules (CLSR) in the upstream oil and gas industry.

Safety Climate as a Dominant Organizational Factor

The results of the study indicate that Safety Climate is an organizational factor that has a positive and significant influence on Safety Compliance in the implementation of Corporate Life Saving Rules (CLSR). This finding indicates that employee perceptions of organizational commitment to safety have a greater influence than individual characteristics or work environment conditions in shaping compliance behavior. In other words, the more positive employee perceptions of the safety climate in the workplace, the higher their tendency to comply with established safety rules. Conceptually, Safety Climate represents employee shared perceptions regarding the extent to which the organization prioritizes safety through policies, communication, resource provision, management involvement, and consistent implementation of safety rules. When employees perceive that safety is truly an organizational priority, they will view compliance with CLSR as a work norm, not simply an administrative obligation.

This finding aligns with the Safety Climate theory, which states that organizational safety culture is a key determinant of employee safety behavior. Research by Bensonch et al. (2022) shows that Safety Climate significantly influences Safety Compliance through improved safety competencies, safety systems, and supervision quality.

In the companies studied, CLSR implementation has been supported by various company policies, such as safety meetings, safety inductions, toolbox meetings, Management Walkthroughs (MWT), safety observations, and regular safety campaigns. These activities shape positive employee perceptions that safety is a core organizational value. This perception encourages employees to comply with CLSR more consistently in their daily operations. These findings imply that improving compliance with CLSR is not sufficient simply through additional procedures or field supervision, but rather requires a focus on strengthening the Safety Climate through increased management commitment, open safety communication, employee involvement in safety decision-making, and consistent implementation of safety policies across all levels of the organization.

The Role of Safety Knowledge and Safety Motivation in Encouraging Worker Compliance

This study shows that Safety Knowledge and Safety Motivation are individual factors that have a positive and significant influence on Safety Compliance. These findings indicate that worker compliance with CLSR is influenced not only by an understanding of safety procedures but also by workers' internal motivation to prioritize safety in all work activities.

Safety knowledge serves as the foundation for safety behavior because it enables workers to recognize hazards, understand the consequences of unsafe actions, and understand correct work procedures according to CLSR regulations. Workers with a good understanding of safety tend to be more confident in making safe decisions when facing dynamic work conditions. On

the other hand, safety motivation acts as a psychological drive that encourages workers to adhere to safety procedures even under operational pressure. Research shows that safety motivation is a crucial factor in transforming knowledge into concrete behavior. This means that workers not only know what to do but also have the will to carry it out consistently.

These findings support the research of Albalá-Genol et al. (2024) and Rizky et al. (2025), which states that safety motivation is one of the individual factors influencing worker safety behavior. Furthermore, research by Ofori et al. (2023) states that safety knowledge is one of the main factors influencing worker safety behavior and compliance with safe work procedures.

In the company that was the object of the research, these results indicate that the effectiveness of the safety program will be more optimal if the company not only increases the frequency of socialization of the rules, but also ensures that workers truly understand the reasons behind each CLSR rule and have the intrinsic motivation to make it a part of the work culture.

The Indirect Effect of Safety Leadership on Safety Compliance through Mediating Variables

One of the most interesting findings in this study is that Safety Leadership does not directly influence Safety Compliance, but has a significant influence on Safety Knowledge, Risk Perception, and Safety Motivation. These results indicate that the role of safety leaders does not directly change workers' compliance behavior, but rather works through psychological processes that shape how workers think, understand risks, and motivate themselves to work safely. In other words, Safety Leadership functions as an enabler, not as a direct determinant of safety behavior.

This phenomenon can be explained through the theory of transformational safety leadership, which states that leaders play a role in building safety values, perceptions, and motivation before ultimately influencing employee behavior. When leaders consistently provide direction, feedback, role models, and effective safety communication, employees will have better safety knowledge, higher risk perceptions, and stronger motivation to work safely.

In the companies studied, field leaders such as supervisors, foremen, and site representatives primarily act as safety facilitators through toolbox meetings, coaching, field observations, and pre-work risk discussions. These activities do not automatically increase compliance, but they do build competency and motivation, which then encourage workers to comply with CLSR.

This finding explains why the direct path of Safety Leadership to Safety Compliance was insignificant, while the total indirect effect showed significant results. Therefore, improving the quality of safety leadership should be directed at leaders' ability to enhance worker competence, motivation, and risk awareness, rather than simply increasing the intensity of supervision of procedure implementation.

The Influence of Work Environment Factors on Safety Motivation: Workload and Work Schedule

The results of the study indicate that Workload and Work Schedule do not have a significant effect on Safety Motivation. These results indicate that the workload and work patterns implemented at the research location are not yet the main factors influencing worker safety motivation. Theoretically, a high workload and long work duration can reduce concentration, increase fatigue, and reduce worker motivation to comply with safety

procedures. However, the results of this study indicate a different condition. This phenomenon is thought to be influenced by the characteristics of the work system that has implemented effective work hour management, shift arrangements, field supervision, and fatigue management. With this system, the negative impact of workload on safety motivation can be minimized, allowing workers to maintain safe behaviors despite facing operational demands.

Furthermore, the majority of respondents were workers with extensive work experience, accustomed to working within roster systems and the operational pressures of the oil and gas industry. This experience allows workers to develop adaptation mechanisms to job demands, reducing workload as a dominant factor in determining safety motivation. These findings suggest that the influence of work environment factors is highly dependent on the organizational context. In companies with robust work management systems, workload and work schedules are not necessarily factors that undermine workers' safety behavior.

Risk Perception and Safety Compliance: The Phenomenon of Risk Normalization in the Upstream Oil and Gas Industry

The results of the study indicate that risk perception does not significantly influence safety compliance. This finding differs from most previous studies, which state that higher risk perception leads to higher safety compliance. One possible explanation is the phenomenon of risk normalization. In high-risk industries such as oil and gas, workers daily encounter activities with high potential hazards, such as lifting, hot work, confined spaces, and the line of fire. Continuous exposure to risk can cause workers to perceive these conditions as a normal part of their work activities, so that risk perception is no longer a primary factor in determining safety behavior. This phenomenon may also be influenced by respondents' high work experience. Workers who have worked in high-risk environments for a long time generally develop confidence in their ability to control hazards. This condition can cause risk perception not always to translate into increased compliance with safety procedures.

In the companies studied, these results indicate that improving risk perception alone is not sufficient to improve safety compliance. Companies need to combine risk communication with strengthening the safety climate, increasing safety knowledge, and developing safety motivation so that risk perception can truly translate into safe work behavior. These findings enrich the literature on safety behavior in high-risk industries by demonstrating that the relationship between risk perception and safety compliance is not always linear, but is strongly influenced by organizational characteristics, work experience, and the safety culture that develops in the workplace. This opens up opportunities for further research to further explore the mechanisms of risk normalization among upstream oil and gas workers.

Managerial Implications and Research Contributions

The results of the study indicate that the improvement of Safety Compliance in the implementation of Corporate Life Saving Rules (CLSR) is more influenced by organizational and individual factors than by work environment factors. This finding indicates that the effectiveness of CLSR implementation depends not only on the existence of safety procedures and monitoring of worker compliance, but also on the organization's ability to build a safety culture that encourages workers to comply with the rules consciously and continuously. Therefore, companies need to direct their CLSR implementation strategy towards strengthening factors that have been proven to significantly influence worker compliance behavior.

Based on the research results, there are several strategic recommendations that companies can prioritize. First, strengthening the Safety Climate needs to be a top priority through increased management commitment to safety, more open safety communication, employee involvement in safety-related decision-making, and consistent implementation of CLSR policies at all levels of the organization. Second, improving Safety Knowledge needs to be done through risk-based training, lessons learned from incidents and near misses, emergency response simulations, and more contextual CLSR socialization so that workers not only understand the procedures but also the reasons and consequences of each safety rule. Third, developing Safety Leadership needs to focus on improving the abilities of supervisors and field leaders in coaching, providing constructive feedback, being role models in safety implementation, and building two-way communication that can improve employee knowledge, risk perception, and motivation. Fourth, companies need to strengthen Safety Motivation by providing appreciation for safe behavior, strengthening behavior-based safety programs, and increasing employee involvement in various safety activities so that compliance with CLSR grows as an intrinsic motivation, not solely due to obligation or supervision.

On the other hand, the research results indicate that Risk Perception, Workload, and Work Schedule do not have a significant influence on Safety Compliance in the context of this study. These findings indicate that improving risk perception or managing work environment factors alone is not sufficient to increase worker compliance if it is not accompanied by strengthening the safety climate, increasing safety knowledge, and increasing safety motivation. Therefore, companies need to view these factors as supporting factors that must still be managed, but not as the primary focus in strategies to improve CLSR implementation.

From an academic perspective, this study provides an empirical contribution to the development of a Safety Compliance model in the upstream oil and gas industry by integrating organizational, individual, and work environment factors into a single Partial Least Squares Structural Equation Modeling (PLS-SEM) model. This study also provides evidence that Safety Leadership plays a more indirect role in influencing Safety Compliance through increasing Safety Knowledge, Risk Perception, and Safety Motivation, rather than as a direct influencing factor. In addition, the finding regarding the insignificant influence of Risk Perception, Workload, and Work Schedule indicates that the relationship between safety variables is strongly influenced by organizational characteristics and the safety culture that develops in the upstream oil and gas industry. These findings enrich the literature on occupational safety behavior, particularly in the implementation of Corporate Life Saving Rules (CLSR) and can be a basis for further research to test this model in other oil and gas companies and other high-risk industrial sectors.

CONCLUSION

This study aimed to analyze the factors influencing Safety Compliance in the implementation of Corporate Life Saving Rules (CLSR) in the upstream oil and gas industry using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. Based on the research findings and discussion, several conclusions were drawn as follows.

First, Safety Climate was identified as the most influential organizational factor in improving Safety Compliance in CLSR implementation. This finding indicates that employee perceptions of organizational commitment, safety communication, and the consistent

implementation of safety policies play important roles in shaping compliance behavior toward workplace safety regulations.

Second, Safety Knowledge and Safety Motivation were found to be key individual-level determinants that significantly improved Safety Compliance. Workers with a strong understanding of safety procedures and higher motivation to work safely tended to demonstrate greater compliance in implementing CLSR. These findings confirm that improved compliance depends not only on knowledge of safety requirements but also on the internal motivation to consistently apply them.

Third, Safety Leadership did not have a direct effect on Safety Compliance but demonstrated an indirect effect through Safety Knowledge, Risk Perception, and Safety Motivation. This finding suggests that safety leaders primarily function as facilitators who develop employee competence, awareness, and motivation, which subsequently contribute to CLSR compliance behavior.

Fourth, Risk Perception did not significantly affect Safety Compliance, although it was positively influenced by Safety Leadership and Safety Climate. This finding indicates that increased risk awareness among workers does not necessarily result in improved compliance behavior toward CLSR. In the context of the upstream oil and gas industry, this condition may be associated with risk normalization, in which repeated exposure to high-risk activities causes workers to perceive hazards as routine aspects of work, reducing the role of risk perception as a primary determinant of safety behavior.

Fifth, Workload and Work Schedule did not significantly affect Safety Motivation or Safety Compliance in this study. These results indicate that existing workload management practices, work schedule arrangements, and operational controls were sufficient to maintain worker safety motivation, suggesting that work environment factors were not the primary determinants of CLSR compliance.

Sixth, improving the effectiveness of Corporate Life Saving Rules (CLSR) implementation requires an integrated approach involving the strengthening of Safety Climate, enhancement of Safety Knowledge, development of Safety Leadership, and reinforcement of Safety Motivation as key factors influencing worker safety behavior. The findings indicate that CLSR implementation success is influenced more strongly by organizational and individual psychological factors than by work environment factors. Therefore, this study provides an empirical contribution to the development of safety compliance models in the upstream oil and gas industry and offers a foundation for companies to develop more effective and sustainable safety culture strategies to support the achievement of the Zero Fatality target.

REFERENCES

Albalá-Genol, J., Díaz-Fúnez, P. A., Martín-Martín, F. G., & Mañas-Rodríguez, M. A. (2024). Occupational Safety from an Individual Perspective: The Influence of Extraversion on Compliance with Safety Standards for Emergency Employees and Nurses. *Merits*, *4*(3), 251–262. https://doi.org/10.3390/merits4030018

Ansong, A., Amadu, S. S., & Ahomka Yeboah, M. (2025). Ethical leadership, safety climate, and employee health and safety: lessons from the oil and gas industry in Ghana. *International Journal of Ethics and Systems*, *41*(2), 392–410. https://doi.org/10.1108/IJOES-02-2023-0027

Bensonch, C., Argyropoulos, C. D., Dimopoulos, C., Varianou Mikellidou, C., & Boustras, G. (2022). Analysis of safety climate factors and safety compliance relationships in the oil and gas industry. *Safety Science*, *151*, 105744. https://doi.org/10.1016/j.ssci.2022.105744

Guzman, J., Recoco, G. A., Pandi, A. W., Padrones, J. M., & Ignacio, J. J. (2022). Evaluating workplace safety in the oil and gas industry during the COVID-19 pandemic using occupational health and safety Vulnerability Measure and partial least square Structural Equation Modelling. *Cleaner Engineering and Technology*, *6*, 100378. https://doi.org/10.1016/j.clet.2021.100378

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Mediation Analysis*. https://doi.org/10.1007/978-3-030-80519-7_7

Haji-othman, Y., Sholeh, M., & Yusuff, S. (2022). Assessing Reliability and Validity of Attitude Construct Using Partial Least Squares Structural Equation Modeling (PLS-SEM). *International Journal of Academic Research in Business and Social Sciences*, *12*(5), 378–385. https://doi.org/10.6007/IJARBSS/v12-i5/13289

IOGP. (2024). *IOGP Safety performance indicators - 2023 data*. Retrieved from International Association of Oil & Gas Producers website: https://www.iogp.org/bookstore/product/iogp-safety-performance-indicators-2023-data/

Kusmawan, D., Izhar, M. D., & Aswin, B. (2024). Assessing the relationship between mental workload and work fatigue among oil and gas workers in PT X, Jambi Province, Indonesia: PLS-SEM analysis. *Journal of Public Health Research*, *13*(4). https://doi.org/10.1177/22799036241287660

Masudin, I., Tsamarah, N., Restuputri, D. P., Trireksani, T., & Djajadikerta, H. G. (2024). The impact of safety climate on human-technology interaction and sustainable development: Evidence from Indonesian oil and gas industry. *Journal of Cleaner Production*, *434*, 140211. https://doi.org/10.1016/j.jclepro.2023.140211

Mathisen, G. E., Tjora, T., & Bergh, L. I. V. (2022). Speaking up about safety concerns in high-risk industries: Correlates of safety voice in the offshore oil rig sector. *Safety Science*, *145*, 105487. https://doi.org/10.1016/j.ssci.2021.105487

Ofori, E. K., Aram, S. A., Saalidong, B. M., Gyimah, J., Niyonzima, P., Mintah, C., & Ahakwa, I. (2023). Exploring new antecedent metrics for safety performance in Ghana's oil and gas industry using partial least squares structural equation modelling (PLS-SEM). *Resources Policy*, *81*. https://doi.org/10.1016/j.resourpol.2023.103368

Palendeng, F. O., & Bernarto, I. (2022). Pengaruh Iklim Keselamatan, Sistem Manajemen Keselamatan, dan Perilaku Keselamatan terhadap Budaya Keselamatan Staf Klinis di RS Gunung Maria. *JMBI UNSRAT (Jurnal Ilmiah Manajemen Bisnis Dan Inovasi Universitas Sam Ratulangi)*, *9*(3), 1599–1616. https://doi.org/10.35794/jmbi.v9i3.44511

Pradewa, R. T., & Mahardayani, I. H. (2023). Hubungan Self Awareness dan Safety Climate Terhadap Safety Behavior pada Karyawan Bengkel Mobil di PT. X. *Jurnal Psikologi Perseptual*, *8*(1), 112–123. https://doi.org/10.24176/perseptual.v8i1.10254

Rahim, H., Dapari, R., Che Dom, N., & Mohd Noor, M. I. (2024). Decoding stakeholder priorities of safety culture preferences in the oil and gas industry. *Scientific Reports*, *14*(1), 20735. https://doi.org/10.1038/s41598-024-71294-6

Rizky, N., Mansur, A., Purnomo, H., Sudiarno, A., & Wangsa, I. D. (2025). Influence of Safety Leadership Styles on Safety Behaviour: The Mediating Role of Safety Climate, Knowledge, and Motivation in Indonesia's Oil and Gas Construction Project. *International Journal of Safety and Security Engineering*, *15*(1), 31–42. https://doi.org/10.18280/ijsse.150104

Saedi, A. M., Ab. Majid, A., & Isa, Z. (2020). Relationships between safety climate and safety participation in the petroleum industry: A structural equation modeling approach. *Safety Science*, *121*, 240–248. https://doi.org/10.1016/j.ssci.2019.08.045

Truman, D., & Dewi, R. S. (2024). The Analysis of the Effect of a Mental Workload and Burnout on Employees' Safety Behavior in the Oil and Gas Industry Using Roster Systems. *Engineering Proceedings*, *76*(1), 1–8. https://doi.org/10.3390/engproc2024076001

Wang, D., Mao, W., Zhao, C., Wang, F., & Hu, Y. (2023). The cross-level effect of team safety-specific transformational leadership on workplace safety behavior: The serial mediating role of team safety climate and team safety motivation. *Journal of Safety Research*, *87*, 285–296. https://doi.org/10.1016/j.jsr.2023.05.001

Won, S., Choi, J., & Kim, K. (2024). Development of Sustainable Industrial Safety and Health Policy for Electronic Industry in Korea: A Study on the Relationship Between Safety Leadership of Managers, Safety Climate, and Safety Behavior. *Sustainability (Switzerland)*, *16*(23). https://doi.org/10.3390/su162310308