

Analysis of The Relationship Between Safety Climate and Safety Behavior Among Construction Workers at PT X in 2026

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Abstract

The construction industry in the oil and gas sector involves a high level of occupational safety risk due to its complex and dynamic work activities, involvement of multiple parties, and changing site conditions. In addition to the implementation of safety systems and procedures, a favorable safety climate is essential to support workers' safety behavior. Therefore, this study aimed to analyze the relationship between safety climate and safety behavior, as well as individual factors, among construction workers at PT X in 2026. This study employed a quantitative approach with a cross-sectional design involving 230 workers selected through proportional random sampling. Safety climate was measured using the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50), while safety behavior was assessed using the Safety Behavior Scale. Data were analyzed using univariate and bivariate analyses, including the Chi-square test, odds ratios (ORs), and 95% confidence intervals (CIs). The results showed that the mean safety climate score was 3.45 and the mean safety behavior score was 3.41 on a 1–4 scale. Based on the median cut-off value, 52.6% of respondents had an unfavorable safety climate, and 51.3% had unfavorable safety behavior. All dimensions of safety climate were significantly associated with safety behavior ($p < 0.001$). Workers with an unfavorable safety climate had 16.94 times higher odds of exhibiting unfavorable safety behavior compared with workers with a favorable safety climate. The strongest association was found in Dimension 6, namely safety communication, learning, and trust in co-workers' safety competence ($OR = 18.00$). A work tenure of 1–3 years was also significantly associated with safety climate ($p = 0.049$; $OR = 1.94$). This study concludes that strengthening safety behavior requires improvements in safety communication and learning, management commitment, supervisory roles, consistent implementation of safety procedures, and targeted development programs for workers with 1–3 years of tenure while continuing to consider the needs of other worker groups.

INTRODUCTION

The construction industry is one of the sectors with a high risk of occupational accidents due to its complex and dynamic work characteristics, involvement of multiple parties, and dependence on rapidly changing field conditions. In construction projects within the oil and gas sector, these risks are greater because workers face not only general construction hazards but also potential hazards associated with operational areas, such as flammable materials, high-pressure systems, hazardous energy, mobile equipment, lifting operations, excavation activities, and simultaneous operations (SIMOPS).

In Indonesia, occupational accidents remain a serious issue. Based on data from the Ministry of Manpower of the Republic of Indonesia, there were 462,241 occupational accident cases throughout 2024. In the construction sector, Bria et al. (2024) explained that the increasing demand for facility and infrastructure development in Indonesia has also contributed to the growth in the number of construction workers and their exposure to accident risks. This condition indicates that construction safety continues to require serious attention, particularly in high-risk projects.

Construction accidents are not only influenced by technical conditions and the working environment but are also closely associated with human factors. Masiku et al. (2024) found that human factors were the dominant cause of construction accidents in Indonesia, accounting for 50%, followed by equipment factors at 44%. These findings indicate that the availability of safety procedures, equipment, and systems is insufficient without being supported by consistent worker safety behavior. In other words, risk control depends not only on the availability of safety systems but also on how workers understand, comply with, and participate in implementing safety practices in the workplace.

One of the factors that can influence safety behavior is safety climate. Safety climate reflects workers' perceptions of management commitment, safety communication, K3 priorities, training, supervisor support, and consistency in implementing safety rules in the workplace. Neal and Griffin (2006) explained that safety climate can influence safety behavior through increased worker safety knowledge and motivation. Thus, workers with positive safety perceptions tend to demonstrate higher compliance with safety procedures and participate more actively in safety activities.

Construction safety conditions in Indonesia are also associated with the safety climate in the workplace. Kadir et al. (2022) found that the safety climate in the Indonesian construction industry is generally categorized as fairly good; however, weaknesses remain in safety priorities, implementation of K3 regulations, availability of safety resources, and consistency of safety practices in the field. This study confirms that a gap exists between safety communication and actual safety practices, indicating that strengthening the safety climate is necessary to ensure that safety becomes a genuine priority in construction activities.

The relationship between safety climate and safety behavior is also supported by various previous studies. Lyu et al. (2018) found a significant positive relationship between safety climate and construction workers' safety behavior, both in terms of safety compliance and safety participation. Furthermore, the study demonstrated that improved safety behavior was associated with reductions in near misses and occupational injury incidents. Hertanto et al. (2023) also showed that improvements in safety climate can contribute to enhanced worker safety behavior. This indicates that when workers perceive safety as an organizational priority supported by management commitment, safety communication, training, supervisory leadership, and consistent implementation of safety rules, they are more likely to comply with procedures and actively participate in safety activities.

PT X has been operating since 2019 by undertaking critical construction projects in the oil and gas sector. As work complexity, the number of workers, contractor involvement, and changes in field conditions increase, the potential for safety hazards also increases. The urgency of this research is reinforced by the results of the safety culture survey conducted at PT X. In 2024, PT X reached the Proactive level with a score of 4.11. However, in 2025, the results of

the Safety Leadership survey and the implementation of Corporate Life Saving Rules showed a decrease in the average score to 2.75, placing the organization at the Calculative level. This condition indicates that although safety systems, procedures, and standards are already established, field-level safety implementation still requires improvement to ensure consistent worker safety behavior.

Based on these conditions, a gap exists between the availability of safety systems and the implementation of worker safety behavior, particularly when facing time pressures, work targets, heavy equipment operations, high-risk activities, and changing field conditions. This gap indicates that although safety regulations and procedures are available, their implementation in practice continues to encounter various challenges, including inconsistent supervision, ineffective safety communication, and limited worker participation in safety activities (Clarke, 2013; Vinodkumar & Bhasi, 2010). Therefore, this study needs to be conducted to analyze the relationship between safety climate and safety behavior among construction workers at PT X in 2026. This research is expected to contribute to the development of more effective occupational safety improvement strategies, particularly by identifying the safety climate dimensions that most strongly influence worker safety behavior. The benefits of this research include providing policy recommendations for company management, developing more targeted training programs, and increasing safety awareness among construction workers.

METHOD

This study employed a quantitative approach with a cross-sectional design to analyze the relationship between independent and dependent variables measured at a single point in time. The quantitative approach was selected because the study aimed to objectively examine the relationship between variables through statistical analysis (Creswell, 2014; Sugiyono, 2019). The independent variable was safety climate, measured through workers' perceptions of safety implementation in the workplace, including management commitment, supervisory leadership, safety communication, training, safety procedures, worker involvement, and support for reporting unsafe conditions. The dependent variable was safety behavior, measured through workers' safety-related actions, including safety compliance and safety participation. This study aimed to determine the relationship between safety climate and safety behavior among construction workers at PT X in 2026.

The study population consisted of all 544 construction workers at PT X. The sample was selected using a proportional random sampling technique, resulting in 230 workers based on the Slovin formula with a 5% margin of error. This technique was applied to ensure proportional representation of each population subgroup (Sugiyono, 2019). The research instrument consisted of three sections: respondent demographic characteristics, the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) to measure safety climate, and the Safety Behavior Scale to measure safety behavior. The NOSACQ-50 consists of 50 items covering seven dimensions of safety climate (Kines et al., 2011), while the Safety Behavior Scale, adapted from Neal and Griffin (2006), consists of 14 items covering two dimensions. Both instruments used a 1–4 Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree).

Instrument validity and reliability testing were conducted through a pilot study involving 30 respondents with characteristics similar to those of the research sample. Validity was assessed using the Pearson Product-Moment correlation test with the criterion of $r\text{-count} > r\text{-table}$ (0.361), while reliability was assessed using Cronbach's Alpha with a criterion of $\alpha > 0.70$. The results indicated that all items were valid, with validity coefficients ranging from 0.412 to 0.789. The Cronbach's Alpha values were 0.871 for NOSACQ-50 and 0.834 for the Safety Behavior Scale, indicating good instrument reliability.

Data collection was conducted through direct questionnaire distribution to respondents from January to February 2026, supported by field observations and documentation studies. The research procedure consisted of three stages: preparation (research permits, instrument preparation, and pilot testing), implementation (questionnaire distribution and observations), and completion (data processing and analysis). Data analysis was performed using SPSS version 26 and SmartPLS 4.0. The analysis included univariate analysis (frequency distribution, mean, median, and standard deviation), bivariate analysis (Chi-square test and odds ratio calculation with 95% confidence intervals), and descriptive analysis of secondary data to support the interpretation of research findings.

RESULTS AND DISCUSSION

Univariate Results

Respondent Characteristics

Based on the number of respondents in this study, it is 230 people. The majority of respondents were male, which was 211 people or 91.7%, while female respondents were 19 people or 8.3%. This condition shows that the study respondents are dominated by male workers, in accordance with the characteristics of construction work which are generally more carried out by male workers as stated in table 1.

Table 1. Responsive Distribution Table

Klasifikasi	Frequency (N)	Presentase
Gender		
Male	211	91,7%
Women	19	8,3%
Education		
≤ High School	148	64,3%
PT	82	35,7%
Tenure		
< 1 year	144	62,6%
1-3 years	51	22,2%
4-5 years	35	15,2%
Job Level		
Supervisor	49	21,3%
Employees	181	78,7%
Employee Status		
Permanent	8	3,5%
Kontrak	222	96,5%

Source: Primary Data, 2026.

Referring to the table, it can be seen that the level of education, the majority of respondents have the last education ≤ high school, which is 148 people or 64.3%, while respondents with a college education are 82 people or 35.7%. This shows that most of the

respondents are from secondary education groups who are generally directly involved in fieldwork. This finding is in line with the characteristics of the construction workforce in Indonesia which is dominated by workers with secondary education or lower backgrounds (Kadir et al., 2022; Martviyori & Lubis, 2022).

Based on the working period, most of the respondents had a working period of less than 1 year, which was 144 people or 62.6%. Respondents with a working period of 1-3 years were 51 people or 22.2%, while 35 people or 15.2% had a working period of 4-5 years. This condition shows that most of the respondents are workers with relatively new working periods, so coaching and strengthening the implementation of occupational safety still needs to be carried out on an ongoing basis. These results indicate a high level of workforce turnover in construction projects, which can have an impact on the lack of experience and understanding of workers regarding safety procedures specific to the project site (Chen et al., 2021; Guo et al., 2021).

Based on the level of position, the majority of respondents were workers, namely 181 people or 78.7%, while respondents with supervisory positions were 49 people or 21.3%. Meanwhile, based on employment status, most of the respondents had contract status, namely 222 people or 96.5%, while respondents had permanent status only 8 people or 3.5%. This illustrates that the study respondents are dominated by field workers with contract work status. This condition shows that the majority of the workforce in the construction sector are contract workers who have temporary employment ties, which can affect their commitment and motivation towards occupational safety (Clarke, 2010; Probst et al., 2019).

Safety Climate

Descriptive analysis on the safety climate dimension was carried out to find out the picture of workers' perception of the implementation of safety in the work environment. The measurement of *safety climate* in this study refers to the NOSACQ-50 dimension which consists of seven dimensions, including management commitment and priority, safety empowerment by management, management fairness to safety, worker commitment to safety, worker safety priority, safety communication and learning, and trust in the safety system.

The results of the analysis are presented in the form of mean values, standard deviation, median, minimum values, maximum values, and normality test results. Higher values indicate a better perception of the safety climate. The descriptive results of each *safety climate dimension* can be seen in the following Table 2.

Table 2. Safety Climate Dimensions Based on NOSACQ-50

Variabel	N	Mean	SD	Median	Min	Max
1. Management commitments and priorities	230	3.37	0.62	3.50	1.00	4.00
2. Safety empowerment by management	230	3.44	0.58	3.50	1.00	4.00
3. Management's fairness to safety	230	3.44	0.59	3.50	1.00	4.00
4. Employee commitment to safety	230	3.50	0.58	3.50	1.00	4.00
5. Prioritize worker safety	230	3.51	0.58	3.50	1.00	4.00
6. Communication and safety learning	230	3.42	0.54	3.50	1.00	4.00
7. Trust in the security system	230	3.48	0.57	3.50	1.00	4.00
Safety Climate	230	3.45	0.51	3.50	1.14	4.00

Source: Primary Data, 2026, based on the NOSACQ-50 developed by Kines et al. (2011).

Based on the results of the descriptive analysis, all dimensions of safety climate showed a relatively high average value in the range of 3.37--3.51 on a scale of 1--4. The dimension with the highest average is the priority of worker safety (mean = 3.51; SD = 0.58), followed by workers' commitment to safety (mean = 3.50; SD = 0.58), while the lowest average is found in management commitments and priorities (mean = 3.37; SD = 0.62). The relatively high mean values indicate that generally workers have positive perceptions of the safety climate in the workplace, although there is still room for improvement in aspects of management commitment and safety communication. The median value of the entire dimension was 3.50, indicating that most respondents gave a positive assessment of the safety climate in the workplace. Overall, the safety climate score had an average of 3.45 ± 0.51 with a median of 3.50, indicating a good perception of the safety climate in the study population. The results of the normality test showed that all variables had a p-value of < 0.05 .

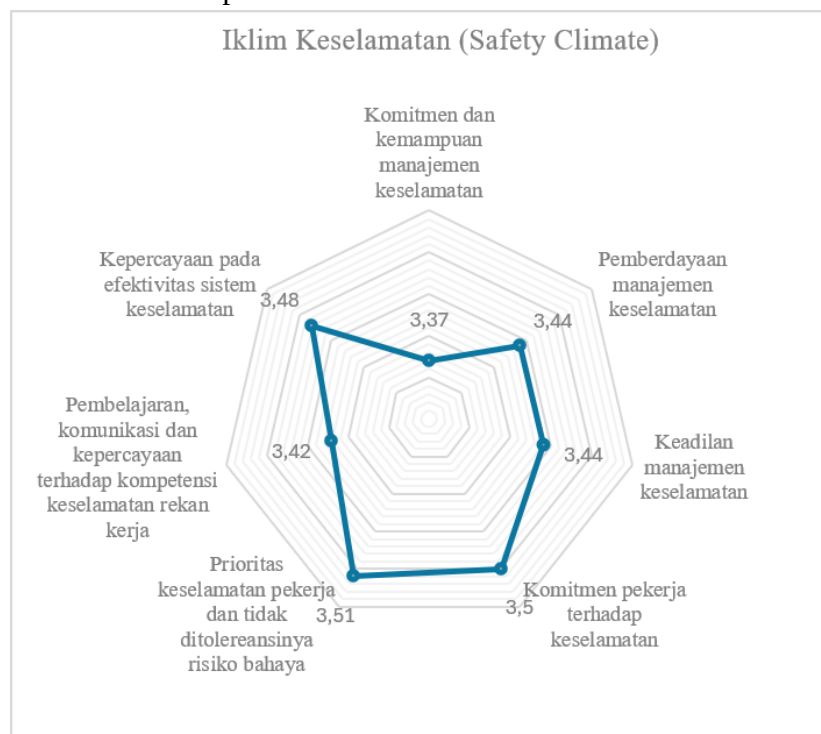


Figure 1. Safety Climate Diagram
Source: Processed Primary Data, 2026.

Based on the *safety climate* diagram image above, all dimensions of the safety climate have an average value between 3.37–3.51. The dimension with the highest average value was worker safety priority and risk denial of 3.51, followed by worker commitment to safety of 3.50. These results show that the strength of the safety climate is mainly found in the commitment of workers in prioritizing safety, adhering to the principles of safe work, and not accepting risks that can be dangerous during the implementation of work. Confidence in the effectiveness of the safety system also showed a relatively good value with an average of 3.48.

Meanwhile, the dimensions of priority, commitment, and management competence towards safety obtained the lowest average score, which was 3.37. The dimensions of communication, learning, and trust in the safety competence of colleagues also had a relatively lower value, namely 3.42. Although the difference in average values between dimensions is

not very large, the results show that real management support, two-way safety communication, delivery of lessons learned from incidents, and follow-up to reports and employee feedback are still areas that need to be strengthened.

Table 3. Dimension of *Safety Climate* by Category

Variabel	Good, n (%)	Not Good, n (%)	Total
1. Management commitments and priorities	83 (36.1%)	147 (63.9%)	230
2. Safety empowerment by management	92 (40.0%)	138 (60.0%)	230
3. Management's fairness to safety	94 (40.9%)	136 (59.1%)	230
4. Employee commitment to safety	106 (46.1%)	124 (53.9%)	230
5. Prioritize worker safety	98 (42.6%)	132 (57.4%)	230
6. Communication and safety learning	80 (34.8%)	150 (65.2%)	230
7. Trust in the security system	97 (42.2%)	133 (57.8%)	230
<i>Safety Climate</i>	109 (47.4%)	121 (52.6%)	230

Source: Processed Primary Data, 2026.

Based on the categorization of categories, most respondents were in the bad category in almost all dimensions of safety climate. The overall proportion of respondents with the good category was 47.4% while the bad was around 52.6%. The dimension with the largest proportion of the bad category was communication, learning, and trust in the safety competence of colleagues at 65.2%, followed by the dimensions of priority, commitment, and management competence towards safety at 63.9%. Meanwhile, the largest proportion of the good category is found in the dimension of workers' commitment to safety, which is 46.1%. Overall, 52.6% of respondents had a safety climate in the bad category, while 47.4% of respondents were in the good category.

Safety Behavior Overview

The safety behavior variables in this study consist of two dimensions, namely *safety compliance* and *safety participation*. Descriptive analysis was carried out to see the tendency of respondents' safety behavior in each of these dimensions. The results of the analysis are presented in Table 4.

Table 4. Safety Behavior Dimension

Variabel	N	Mean	SD	Median	Min	Max
Safety Compliance	230	3.38	0.48	3.40	1.40	4.00
Safety Participation	230	3.44	0.51	3.40	1.20	4.00
Total Safety behavior	230	3.41	0.45	3.40	1.50	4.00

Source: Primary Data, 2026.

In the *safety behavior variable*, the average score is also in the relatively high category. *Safety participation* has the highest average (mean = 3.44; SD = 0.51), followed by overall *safety behavior* score (mean = 3.41; SD = 0.45) and *Safety compliance* (mean = 3.38; SD = 0.48). The median of all indicators was around 3.40, indicating that the majority of respondents reported good safety behavior. Thus, both the perception of the safety climate and worker safety behavior are both at a relatively high level in this study. The results of the normality test showed that all variables had a $p < 0.05$.

Table 5. Safety Behavior Dimensions by Category

Variabel	Good, n (%)	Not Good, n (%)	Total
Safety Compliance	95 (41.3%)	135 (58.7%)	230
Safety Participation	111 (48.3%)	119 (51.7%)	230
Total Safety behavior	112 (48.7%)	118 (51.3%)	230

Source: Primary Data, 2026.

Based on the results of the category grouping, most of the respondents were in the category of not good in both dimensions of safety behavior. In the safety compliance dimension, as many as 135 respondents or (58.7%) were in the bad category, while 95 respondents or (41.3%) were in the good category. In the safety participation dimension, as many as 119 respondents or (51.7%) were in the bad category and 111 respondents or (48.3%) were in the good category.

Overall, as many as 118 respondents or (51.3%) had safety behavior in the bad category, while 112 respondents or (48.7%) were in the good category. The dimension with the largest proportion of the bad category is safety compliance, which is (58.7%). These results show that weaknesses in safety behavior are more visible in the aspect of compliance with safety provisions and procedures. Although the proportion of good categories in *safety participation* is relatively larger than in *safety compliance*, most of the respondents in this dimension are still in the bad category. Therefore, it is necessary to strengthen compliance with safe work procedures while increasing the active involvement of workers in workplace safety activities.

Normality Test

The normality test in this study, the normality test was carried out using **Kolmogorov–Smirnov** because the number of respondents was more than 50 people, namely 230 respondents. The data is said to be normally distributed if **the p-value is > 0.05**, while the data is said to be not normally distributed if **the p-value is ≤ 0.05**.

Table 6. Kolmogorov–Smirnov Data Normality Test

Variabel	N	Mean	Median	SD	Min-Max	p-value	Distribution
<i>Safety Climate</i>	230	3,45	0,51	3,50	1,14–4,00	0,0003	Abnormal
<i>Safety Behavior</i>	230	3,41	0,45	3,50	1,50–4,00	0,0261	Abnormal

Source: Primary Data, 2026.

Based on the table above, the safety climate variable has a p-value of 0.0003 and the safety behavior variable has a p-value of 0.0261. Both values are smaller than 0.05, so it can be concluded that the safety climate and safety behavior data are not normally distributed.

Bivariate Results

The relationship between individual characteristics and *climate safety*

Bivariate analysis was conducted to determine the relationship between individual characteristics of respondents and the *safety climate* in construction workers at PT X. Individual characteristics analyzed included gender, education level, working period, and position level.

The *safety climate* category in this analysis is grouped into *high and low safety climate*. Statistical tests were carried out to see whether or not there was a meaningful relationship between each individual characteristic and *the safety climate*. In addition, the *Odds Ratio* (OR) value is used to see the high chance of each category of respondents to low *safety climate* conditions.

Table 7. The Relationship of Individual Characteristics to *Climate Safety*

Predictor	Category	Safety Climate		p-value	OR 95%CI
		Good n (%)	Not Good n (%)		
Gender	Women	8 (42.1%)	11 (57.9%)	0.630	1.00 (ref)
	Male	101 (47.9%)	110 (52.1%)		0.79 (0.30-2.04)
Education	High School or less	72 (48.6%)	76 (51.4%)	0.608	1.00 (ref)
	College	37 (45.1%)	45 (54.9%)		1.15 (0.67-1.99)
	< 1 year	74 (51.4%)	70 (48.6%)		1.00 (ref)
Working period	1-3 years	18 (35.3%)	33 (64.7%)	0.049	1.94 (1.01-3.81)
	> 3 years	17 (48.6%)	18 (51.4%)	0.765	1.12 (0.53-2.36)
Job level	Supervisor	24 (49.0%)	25 (51.0%)	0.802	1.00 (ref)
	Employees	85 (47.0%)	96 (53.0%)		1.08 (0.57-2.04)
	Age	-	-	0.619	0.99 (0.97-1.02)

Source: Primary Data, 2026.

Based on the table above, most of the male respondents had a safety climate in the bad category of (52.1%), as well as in the female group of (57.9%). Respondents with a university education were more in the category of a bad safety climate (54.9%) than respondents with a high school education or less (51.4%). Based on the working period, the highest proportion of unfavorable safety climate was found in respondents with a working period of 1-3 years of work (64.7%), while in respondents with a working period of less than 1 year and more than 3 years of work were (48.6%) and (51.4%) respectively. At the position level, the proportion of safety climate that is not good is slightly higher for workers (53.0%) than for supervisors (51.0%).

The results of the bivariate analysis showed that only the 1–3 years of service was significantly related to the safety climate with a value of $p = 0.049$. Respondents with a working period of 1–3 years had an OR of 1.94 times greater to have a poor safety climate than respondents with a working period of less than 1 year (OR = 1.94; 95% CI: 1.01–3.81). Meanwhile, gender, education level, job title, age, and working period of more than 3 years did not show a meaningful relationship with safety climate because it had a p value of > 0.05 .

The Relationship of Individual Characteristics to Safety Behavior

The characteristics of individuals with safety *behavior* of respondents were analyzed to see if there were differences in the proportion of *safety behavior* based on gender, education level, working period, position level, and age. In this analysis, *safety behavior* is categorized into high and low. The results of the analysis are presented in the form of frequency distribution, percentage, p -value, and Odds Ratio (OR) to describe the chances of each group against the low *safety behavior category*. Details of the results of the analysis of the relationship between individual characteristics and *safety behavior* are shown in Table 8 below.

Table 8. The Relationship of Individual Characteristics to Safety Behavior

Predictor	Category	Safety Behavior		p-value	OR 95%CI
		Good n (%)	Not Good n (%)		
Gender	Women	9 (47.4%)	10 (52.6%)	0.904	1.00 (ref)
	Male	103 (48.8%)	108 (51.2%)		0.94 (0.36-2.43)
Education	High School or less	67 (45.3%)	81 (54.7%)	0.163	1.00 (ref)
	College	45 (54.9%)	37 (45.1%)		0.68 (0.39-1.17)
Working period	< 1 year	74 (51.4%)	70 (48.6%)	0.084	1.00 (ref)
	1-3 years	19 (37.3%)	32 (62.7%)		1.78 (0.93-3.47)
	> 3 years	19 (54.3%)	16 (45.7%)		0.89 (0.42-1.87)
Job Level	Supervisor	28 (57.1%)	21 (42.9%)	0.184	1.00 (ref)
	Employees	84 (46.4%)	97 (53.6%)		1.54 (0.82-2.94)
	Age	-	-		0.99 (0.96-1.01)

Source: Primary Data, 2026.

Based on the table mentioned above, the proportion of respondents with poor safety behavior is slightly higher in women, namely (52.6%), compared to men (51.2%). Based on education level, respondents with high school education or more or less were in the category of poor safety behavior (54.7%) compared to respondents with a college education of (45.1%). Based on the service period, the highest proportion of bad safety behavior was found in respondents with a working period of 1-3 years (62.7%), followed by respondents with a working period of less than 1 year (48.6%), while the lowest proportion was found in respondents with a working period of more than 3 years (45.7%). Based on the position level, the proportion of safety behavior that is not good for workers is (53.6%), higher than supervisors (42.9%).

The results of the bivariate analysis showed that there was no meaningful relationship between gender, education level, working period, position level, or age with safety behavior, because all variables had a $p > 0.05$. Therefore, the odds ratio values of these variables are not interpreted further because they do not show a statistically significant relationship.

The relationship between *safety climate* and *safety behavior*

The next analysis was carried out to assess the relationship between *the dimension of safety climate* and *safety behavior* in construction workers. This analysis is important because *safety climate* describes workers' perceptions of commitment, priorities, communication, learning, and safety systems in the workplace, while *safety behavior* shows how workers implement safety behaviors in daily work activities. In this subchapter, each dimension of *safety climate* is analyzed against the categories of high and low safety behavior. The results of the analysis are presented in the form of frequency distribution, percentage, *p-value*, and *Odds Ratio* (OR) to see the greater chance of respondents with *low safety climate* to *low safety behavior*. Details of the results of the analysis of the relationship between *safety climate* and *safety behavior* are shown in Table 9 below.

Table 9. The Relationship between *Safety Climate* and *Safety Behavior*

Predictor	Category	Safety Behavior		p-value	OR 95%CI
		Good n (%)	Not Good n (%)		
1. Management commitments and priorities	Good	68 (81.9%)	15 (18.1%)		1.00 (ref)
	Not Good	44 (29.9%)	103 (70.1%)	<0.001	10.61 (5.61-21.17)
2. Safety empowerment by management	Good	74 (80.4%)	18 (19.6%)		1.00 (ref)
	Not Good	38 (27.5%)	100 (72.5%)	<0.001	10.82 (5.84-20.93)
3. Management's fairness to safety	Good	72 (76.6%)	22 (23.4%)		1.00 (ref)
	Not Good	40 (29.4%)	96 (70.6%)	<0.001	7.85 (4.36-14.62)
4. Employee commitment to safety	Good	80 (75.5%)	26 (24.5%)		1.00 (ref)
	Not Good	32 (25.8%)	92 (74.2%)	<0.001	8.85 (4.93-16.35)
5. Prioritize worker safety	Good	79 (80.6%)	19 (19.4%)		1.00 (ref)
	Not Good	33 (25.0%)	99 (75.0%)	<0.001	12.47 (6.72-24.13)
6. Communication and safety learning	Good	70 (87.5%)	10 (12.5%)		1.00 (ref)
	Not Good	42 (28.0%)	108 (72.0%)	<0.001	18.00 (8.82-40.21)
7. Trust in the security system	Good	78 (80.4%)	19 (19.6%)		1.00 (ref)
	Not Good	34 (25.6%)	99 (74.4%)	<0.001	11.95 (6.45-23.07)
Category: Safety Climate	Good	88 (80.7%)	21 (19.3%)		1.00 (ref)
	Not Good	24 (19.8%)	97 (80.2%)	<0.001	16.94 (9.00-33.31)

Source: Primary Data, 2026.

Based on the table mentioned above, all dimensions of safety climate show a significant relationship with the category of safety behavior. Respondents who had a bad safety climate category showed more bad safety behavior than respondents who had a good safety climate category. The proportion of bad safety behavior in the group with a bad safety climate ranged from (70.1%) to (75.0%), while in the group with a good safety climate ranged from (12.5%) to (24.5%). The results of the bivariate test showed that all dimensions of safety climate were significantly related to safety behavior with a p value of < 0.001.

In the dimensions of priority, commitment, and management competence towards safety, respondents with a poor category had a 10.61 times greater chance of having poor safety behavior than respondents with a good category (OR = 10.61; 95% CI: 5.61–21.17). In the dimension of safety empowerment by management, respondents with a poor category were 10.82 times more likely to have poor safety behavior (OR = 10.82; 95% CI: 5.84–20.93). Furthermore, respondents with poor safety fairness were 7.85 times more likely to have poor safety behavior (OR = 7.85; 95% CI: 4.36–14.62).

In the dimension of worker commitment to safety, the ungood category increased the odds of unfavorable safety behavior by 8.85 times (OR = 8.85; 95% CI: 4.93–16.35). Respondents with worker safety priorities and denial of poor category risk were 12.47 times more likely to have poor safety behavior (OR = 12.47; 95% CI: 6.72–24.13). The strongest relationships were found in the dimensions of communication, learning, and trust in the safety competencies of colleagues. Respondents with a bad category in this dimension were 18.00 times more likely to have poor safety behavior than respondents with a good category (OR = 18.00; 95% CI: 8.82–40.21). Meanwhile, respondents with confidence in the effectiveness of

a safety system in the poor category had an 11.95 times greater chance of having poor safety behavior (OR = 11.95; 95% CI: 6.45–23.07).

Overall, respondents with a bad safety climate category had a 16.94 times greater chance of having poor safety behavior than respondents with a good safety climate (OR = 16.94; 95% CI: 9.00–33.31; $p < 0.001$). These findings suggest that the poorer workers' perceptions of the safety climate, the more likely workers are to exhibit poor safety behavior.

Summary of Bivariate Results

To facilitate understanding of the overall results of the bivariate analysis, the relationship between each dimension of safety climate and overall safety climate and safety behavior is summarized in the following table.

Table 10. Summary of the Relationship between Safety Climate and Safety Behavior

No	Dimensi Safety Climate (NOSACQ)	p-value	OR (95% CI)	Conclusion
1	Management <i>safety priority, commitment, and competence</i>	<0.001	10,61 (5,61–21,17)	Significantly related
2	Management <i>safety empowerment</i>	<0.001	10,82 (5,84–20,93)	Significantly related
3	Management <i>safety justice</i>	<0.001	7,85 (4,36–14,62)	Significantly related
4	Workers ' <i>safety commitment</i>	<0.001	8,85 (4,93–16,35)	Significantly related
5	Prioritas keselamatan pekerja (<i>Workers ' safety priority and risk non-acceptance</i>)	<0.001	12,47 (6,72–24,13)	Significantly related
6	<i>Safety communication, learning, and trust in co-workers' safety competence</i>	<0.001	18,00 (8,82–40,21)	Significantly related
7	Kepercayaan terhadap sistem keselamatan (<i>Workers ' trust in the efficacy of safety systems</i>)	<0.001	11,95 (6,45–23,07)	Significantly related
Overall climate safety		<0.001	16,94 (9,00–33,31)	Significantly related

Source: Primary Data, 2026.

In addition to analyzing the relationship between the dimension of safety climate and safety behavior, this study also analyzes the relationship between individual factors and safety climate and safety behavior. A summary of the results of the analysis is given in the following table.

Table 11. Summary of the Relationship of Individual Factors to *Safety Climate* and *Safety Behavior*

Yes	Individual factors	<i>Safety Climate</i>	<i>Safety Behavior</i>
1	Gender	Insignificant, $p = 0.630$	Insignificant, $p = 0.904$
2	Education	Insignificant, $p = 0.608$	Insignificant, $p = 0.163$
3	Tenure 1–3 years	Signifikan, $p = 0.049$; GOLD = 1.94	Insignificant, $p = 0.084$
4	Working period >3 years	Insignificant, $p = 0.765$	Insignificant, $p = 0.758$
5	Job level	Insignificant, $p = 0.802$	Insignificant, $p = 0.184$
6	Age	Insignificant, $p = 0.619$	Insignificant, $p = 0.346$

Source: Primary Data, 2026.

Based on the summary of the results of the bivariate analysis, all dimensions of safety climate are significantly related to safety behavior. The strongest relationships were found in the dimensions of communication, learning, and trust in the safety competencies of colleagues. In the analysis of individual factors, only the working period of 1-3 years is significantly related to the safety climate. Meanwhile, all individual factors did not show a significant association with safety behavior. These findings confirm the primacy of organizational and perceptual

factors over demographic characteristics in determining safety outcomes, aligning with the theoretical framework proposed by Neal and Griffin (2006) and Zohar (2010) that safety climate serves as a more powerful predictor of safety behavior than individual demographic attributes.

Discussion

The findings of this study provide compelling evidence regarding the significant relationship between safety climate and safety behavior among construction workers at PT X. The overall safety climate score of 3.45 (on a 1-4 scale) and safety behavior score of 3.41 indicate relatively positive perceptions and practices, yet the categorization results reveal that more than half of the respondents (52.6% and 51.3%, respectively) fall into the unfavorable category. This discrepancy between mean scores and categorical distribution suggests that while workers may generally hold positive attitudes toward safety, there remains a substantial proportion whose perceptions and behaviors require improvement. These findings are consistent with Kadir et al. (2022), who found that although the Indonesian construction industry's safety climate is generally adequate, there are significant weaknesses in safety priority aspects, K3 rule implementation, resource availability, and consistency of safety implementation in the field.

The relationship between all safety climate dimensions and safety behavior, with p -values < 0.001 across all dimensions, confirms the theoretical framework proposed by Neal and Griffin (2006) that safety climate serves as a critical antecedent of safety behavior. The strength of this relationship, as evidenced by the odds ratios ranging from 7.85 to 18.00, is particularly noteworthy. The dimension of safety communication, learning, and trust in co-workers' safety competence (Dimension 6) demonstrated the strongest association with safety behavior (OR = 18.00), indicating that workers' perceptions of communication effectiveness, learning opportunities, and trust in their colleagues' safety competence are the most influential factors in shaping safety behavior. This finding aligns with Cooper and Phillips (2004) and Brondino et al. (2012), who found that safety communication and trust are foundational elements in safety climate that directly influence workers' willingness to engage in safety behaviors.

The exceptionally strong relationship found in Dimension 6 can be explained through the lens of social learning theory and social exchange theory. Workers who perceive open communication channels, receive regular safety updates, learn from incidents and near misses, and trust their coworkers' safety competence are more likely to internalize safety values and translate them into consistent safety behaviors (Bandura, 1977; Blau, 1964). This is consistent with Clarke's (2010) integrative model of safety climate, which posits that psychological safety climate influences individual safety outcomes through cognitive and motivational processes. The practical implication is that organizations should prioritize the development of robust safety communication systems, implement effective incident learning mechanisms, and foster trust among workers to enhance safety behavior.

The second strongest relationship was found in Dimension 5, namely workers' safety priority and risk non-acceptance (OR = 12.47), followed by Dimension 7, trust in the efficacy of safety systems (OR = 11.95). These findings suggest that when workers personally prioritize safety and refuse to accept risks, they are more likely to exhibit appropriate safety behaviors. This aligns with the concept of safety motivation, which Neal and Griffin (2006) identified as

a key mechanism linking safety climate to safety behavior. Zohar (2010) also emphasized that workers' personal commitment to safety, reflected in their willingness to reject unsafe conditions, is a critical determinant of safety performance. The relatively lower yet still significant odds ratios for management-related dimensions (Dimensions 1-3, ORs 10.61-10.82) indicate that while management commitment is important, the direct influence of peer and communication factors may be more powerful in shaping day-to-day safety behaviors.

The findings regarding individual characteristics provide important insights for targeted interventions. Only tenure of 1-3 years was significantly associated with safety climate ($p = 0.049$, $OR = 1.94$), while no individual factors were significantly associated with safety behavior. This suggests that workers in the 1-3 year tenure group are particularly vulnerable to negative safety climate perceptions. This finding is consistent with He et al. (2023), who found that workers with moderate tenure often experience a transitional phase where they have acquired enough experience to recognize safety issues but may not have fully internalized safety values and norms. The lack of significant relationships between individual factors and safety behavior aligns with Zohar (2010), who argued that organizational and perceptual factors are more influential than demographic characteristics in determining safety behavior. The study by Lyu et al. (2018) similarly found that safety climate dimensions were stronger predictors of safety behavior than individual characteristics.

The identification of safety communication and learning as the dimension with the strongest relationship to safety behavior has critical implications for safety management strategies. Organizations should implement structured safety communication programs, including daily safety briefings, toolbox talks, and open reporting systems that encourage workers to share safety concerns and lessons learned. Similar approaches have been effective in the oil and gas industry, as documented by Djunaidi et al. (2024), who found that safety climate transformation during company ownership transitions required intensive communication and leadership engagement. This is also supported by Hertanto et al. (2023), who recommended that safety communication and learning should be prioritized to improve safety behavior in Indonesian companies.

The importance of management commitment and safety empowerment, while showing slightly lower ORs compared to communication and peer-related dimensions, remains crucial. The findings indicate that workers who perceive management as genuinely committed to safety and who feel empowered to participate in safety decisions are more likely to exhibit positive safety behavior. This aligns with Clarke and Ward (2006), who found that leader influence tactics and safety climate play important roles in engaging employees' safety participation. Vinodkumar and Bhasi (2010) also emphasized the importance of safety management practices in shaping safety behavior, noting that management commitment is a foundational element of effective safety systems.

The practical implications of this study are multi-fold. First, organizations should invest in enhancing safety communication and learning mechanisms, as these have the strongest influence on safety behavior. Second, targeted development programs should be designed for workers with 1-3 years of tenure, who are at higher risk of having unfavorable safety climate perceptions. Third, management should demonstrate visible commitment to safety and empower workers to participate actively in safety activities. Fourth, consistent implementation of safety procedures should be ensured through regular audits and reinforcement. These

recommendations are consistent with the safety culture maturity model proposed by Hudson (2007) and Fleming (2001), where organizations progress from calculative to proactive levels through systematic improvement of communication, leadership, and worker engagement.

The comparison with previous research strengthens the validity of these findings. Kadir et al. (2022) found that the Indonesian construction industry's safety climate has strengths in worker commitment but weaknesses in management aspects, which is consistent with the higher mean scores found for worker-related dimensions (3.50-3.51) compared to management-related dimensions (3.37) in this study. Hertanto et al. (2023) similarly found that safety climate dimensions, particularly management commitment and safety communication, were significantly associated with safety behavior in Indonesian companies. Alruqi et al. (2018) in their meta-analytic review identified safety communication and management commitment as the most important safety climate dimensions in predicting construction safety performance, which aligns with the findings of this study.

The study also addresses the gap in the literature regarding the specific influence of safety communication and learning on safety behavior, particularly in the Indonesian oil and gas construction context. While previous research has established the general relationship between safety climate and safety behavior (Lyu et al., 2018; Zohar, 2010; Neal & Griffin, 2006), this study provides more granular insights into which dimensions of safety climate are most influential. The strong association found for Dimension 6 suggests that interventions targeting safety communication and learning would yield the greatest improvements in safety behavior, particularly for workers with 1-3 years of tenure.

The relationship between safety climate dimensions and safety behavior can be further understood through the theoretical lens of the Egg Aggregated Model (TEAM) of safety culture proposed by Vierendeels et al. (2018), which emphasizes the dynamic interplay between organizational, group, and individual factors in shaping safety outcomes. The findings of this study support this model, showing that group-level factors (safety communication and trust) and organizational-level factors (management commitment) collectively influence individual safety behavior. This aligns with Schein's (2010) framework of organizational culture, where artifacts (safety procedures), espoused values (management commitment), and basic underlying assumptions (worker trust and commitment) operate at different levels to shape behavior.

The finding that only tenure of 1-3 years was significantly associated with safety climate, while no individual factors were associated with safety behavior, has important theoretical implications. It suggests that the mechanisms linking individual characteristics to safety outcomes are mediated by safety climate perceptions. Workers with 1-3 years of tenure may be particularly susceptible to safety climate influences because they are still in the process of forming their safety attitudes and behaviors, consistent with the socialization and sensemaking processes described by Guldenmund (2010) and Parker et al. (2006). This implies that organizations should pay special attention to workers during this critical period to ensure they develop positive safety perceptions that will guide their future behavior.

In terms of practical implications, this study provides actionable recommendations for PT X and similar organizations in the oil and gas construction industry. First, given the strong influence of Dimension 6, organizations should implement structured safety communication programs, including regular safety meetings, open reporting channels, and systematic incident

learning processes. Second, targeted development programs should be designed for workers with 1-3 years of tenure, who are more vulnerable to unfavorable safety climate perceptions. Third, management should demonstrate visible commitment to safety through active participation in safety activities and consistent enforcement of safety rules. Fourth, supervisors should be trained in safety leadership to effectively support their teams in implementing safety procedures. Finally, organizations should monitor safety climate regularly using validated instruments like NOSACQ-50 and use the results to guide continuous improvement efforts.

This study also contributes to the academic literature by providing empirical evidence from the Indonesian oil and gas construction context, which has been relatively understudied compared to Western contexts. The use of the validated NOSACQ-50 instrument and the rigorous analytical approach strengthen the reliability and validity of the findings. The study demonstrates the applicability of the safety climate framework in the Indonesian context and provides a foundation for future research examining the mechanisms linking safety climate to safety behavior.

In conclusion, the results of this study confirm that safety climate, particularly safety communication and learning, plays a crucial role in shaping workers' safety behavior. The findings highlight the need for organizations to move beyond a calculative approach to safety, where compliance is the primary objective, to a proactive approach where safety is genuinely valued and integrated into all aspects of work. This requires visible management commitment, effective communication and learning mechanisms, supportive supervision, and targeted interventions for vulnerable groups of workers.

CONCLUSION

Based on the results of the study examining the relationship between safety climate and safety behavior among construction workers at PT X in 2026, the following conclusions were drawn. First, the overall conditions of safety climate and safety behavior among construction workers at PT X showed relatively favorable results based on mean scores. The safety climate had a mean value of 3.45 on a 1–4 scale, while safety behavior had a mean value of 3.41. However, based on category classification using the median cut-off value, most respondents were categorized as having an unfavorable safety climate (52.6%) and unfavorable safety behavior (51.3%). The safety climate dimension requiring further attention was Dimension 6, namely safety communication, learning, and trust in co-workers' safety competence, as it had the highest proportion of unfavorable responses (65.2%). In addition, Dimension 1, namely management safety priority, commitment, and competence, had the lowest mean score of 3.37. Regarding safety behavior, the dimension requiring improvement was safety compliance, as it had the lowest mean score of 3.38 and the highest proportion of unfavorable responses (58.7%).

Second, a significant relationship was identified between safety climate and safety behavior among construction workers at PT X. All safety climate dimensions were significantly associated with safety behavior ($p < 0.001$). Respondents with an unfavorable safety climate had 16.94 times higher odds of demonstrating unfavorable safety behavior compared with respondents with a favorable safety climate. The dimension with the strongest association with safety behavior was Dimension 6, namely safety communication, learning, and trust in co-workers' safety competence, with an OR value of 18.00, followed by Dimension 5, namely workers' safety priority and risk non-acceptance, with an OR value of 12.47. These findings

indicate that negative perceptions of safety climate, particularly regarding safety communication, learning, and safety priorities, were associated with a higher likelihood of unfavorable safety behavior among workers.

Third, individual and sociodemographic factors significantly associated with safety climate included work tenure, particularly among workers with 1–3 years of service. Respondents with a work tenure of 1–3 years had 1.94 times higher odds of having an unfavorable safety climate compared with respondents with less than one year of service. Meanwhile, gender, education level, job position, age, and work tenure of more than three years were not significantly associated with safety climate. For the safety behavior variable, none of the individual or sociodemographic factors showed a significant association. These findings indicate that improving safety behavior cannot rely solely on interventions targeting individual characteristics but should focus on strengthening safety climate through improved safety communication, supervision, field leadership, and consistent implementation of safety procedures in the workplace.

For future research, longitudinal studies are recommended to examine the causal relationship between safety climate and safety behavior over time, as well as to investigate the mediating roles of safety motivation and safety knowledge in this relationship. Additionally, qualitative studies exploring workers' perspectives on safety communication and learning processes may provide deeper insights for developing effective safety interventions. Comparative studies across different construction sectors and geographical regions are also recommended to enhance understanding of contextual factors influencing the relationship between safety climate and safety behavior.

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