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Safety Climate as a Determinant of Occupational Safety Performance among Rambutan Palm Oil Mill Workers

Thalia Ika Putri Siregar[1*], Umi Salmah[2], Eka Lestari Mahyuni[3]
University of North Sumatera
Corresponding Author: Thalia Ika Putri Siregar thaliaika09@gmail.com

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ABSTRACT

Occupational safety performance is a reflection of workers' actual behavior in maintaining workplace safety in order to create a decent working environment that aligns with the targets of the Sustainable Development Goals (SDGs). The palm oil mill processing industry has a high risk of accidents due to the intensive interaction of workers with high-temperature and high-pressure machine operations. This study aims to analyze the influence of occupational safety climate including management commitment, safety communication, safety practices, and safety training on safety performance among workers. This study used a quantitative with cross-sectional design. The study population was 137 workers with a sample of 88 workers selected through a purposive sampling technique. Data analysis used the chi-square test and binary logistic regression. The results of this study indicate that there is a significant influence between management commitment (ρ = 0.036), safety communication (ρ = 0.002), safety practices (ρ = 0.001), and safety training (ρ = <0.001) on worker safety performance, while for the results of binary logistic regression it was found that safety training is the most dominant factor influencing safety performance with a value (ρ = 0.003; OR = 4.575). The conclusion of this study was that there was an influence between management commitment, communication, safety practices and training on worker safety performance, with the most dominant determinant being safety communication to workers

INTRODUCTION

Globally, the issue of occupational safety performance has currently become one of the critical focus areas in occupational health and safety (OHS) systems, as it reflects workers' actual behavior in maintaining safety in the workplace. Safety performance is not only related to adherence to safety procedures (safety compliance) but also involves the active engagement of workers in supporting safety activities (safety participation) (Neal & Griffin, 2004). The global context positions occupational safety not merely as an organizational responsibility, but as an integral part of the sustainable development agenda formulated through the Sustainable Development Goals (SDGs), particularly Goal 8 regarding decent work and economic growth. Efforts to improve occupational safety performance represent a tangible contribution toward achieving international targets in creating decent employment for all (United Nations, 2015). Global-scale research indicates that safety performance across various parts of the world remains suboptimal. The average safety performance was recorded at only 2.61 on a 5-point scale, or approximately 52.2%, falling into the moderate-to-low category (Ooshaksaraie & Azadehdel, 2015).

The condition of occupational safety performance in Indonesia has begun to show numerous improvements, although it still faces various structural challenges. National-level safety performance stands at around 78.2 percent (a fairly good category); however, its implementation pattern still tends to be reactive, focusing on post-accident management (Ministry of Manpower of the Republic of Indonesia, 2023). At the local level, specifically in North Sumatra Province, specific safety performance data is still limited. Nevertheless, several studies show that safety behavior indicators, such as the use of personal protective equipment (PPE), have reached 88%, and safety knowledge is relatively good at 85.3%, even though these figures do not fully reflect comprehensive safe working behavior in the field (Wasiyem, 2025).

The palm oil processing industry is a sector with a high level of occupational safety risk. The production process involves large-scale machinery, high temperatures, steam pressure, as well as slippery and noisy working environments, thus demanding a high level of alertness and safety behavior from every worker (Corley & Tinker, 2016). The Rambutan Palm Oil Mill already possesses and has implemented an occupational safety system; however, its existence does not automatically guarantee the formation of safe working behavior. Compliance with PPE usage, the implementation of SOP's, and participation in safety activities are heavily influenced by workers' perceptions of safety itself. In this regard, safety climate plays a key role in shaping workers' safety behavior.

Safety climate is a pivotal factor determining the formation of occupational safety behavior. It reflects workers' perceptions of management commitment, communication, practices, and safety training (Neal et al., 2000). A strong management commitment plays a central role in effectively fostering safe working behavior (Won et al., 2024). This management commitment has not been fully and consistently demonstrated at the Rambutan Palm Oil Mill, as supervision over PPE usage remains lax, and there is a lack of firm action against rule violations.

Effective safety communication serves to increase workers' awareness of various risks in the work area (Erismawati & Lestari, 2026). The information-sharing process at the Rambutan Palm Oil Mill is currently not operating optimally because it relies solely on morning roll calls without any dedicated safety briefings. This causes workers to perceive safety as a secondary priority compared to production targets.

Effective safety system practices, including the implementation of standard operating procedures (SOPs) and the availability of equipment, play an important role in increasing worker compliance (Kumar et al., 2025). However, at the Rambutan Palm Oil Mill, safety practices have not run optimally due to limited facilities and weak procedural implementation in the field. SOPs are only available administratively without adequate understanding, safety equipment is incomplete and substandard, and equipment inspections are not conducted routinely, leaving the risk of hazards high. Furthermore, the absence of a clear incident reporting workflow causes near-miss events to go unreported and disrupts coordination between departments. Workers also tend to bypass procedures to chase production targets, while supervision over compliance and PPE usage remains weak, as it is only conducted during the morning shift lineup by

the chie f engineer rather than by the Occupational Health and Safety Committee. This condition creates a perception that safety practices are merely a formality.

Workers' training and knowledge for working safely can be enhanced through the significant role of safety training (Rahdiana et al., 2024; Wijaya, 2024). Safety training is the subsequent aspect that requires the most attention. The Rambutan Palm Oil Mill itself almost never conducts specialized training or refresher courses regarding occupational safety. This keeps the risk of work accidents in the production area high, as workers rely solely on old habits.

These conditions demonstrate that safety climate is a factor that directly shapes workers' safety performance. A positive safety climate will create a perception that safety is a priority, thereby encouraging workers to exhibit safety behaviors through compliance with procedures and active involvement in safety activities. Conversely, a weak safety climate leads to low safety performance. Thus, safety performance is not only influenced by the existence of regulations but heavily depends on how the safety climate is perceived and executed within the work environment.

A supportive work environment directly influences the safety climate in the workplace. Workers tend to be more compliant and mindful of safety when the company's safety atmosphere is well-maintained (Wijaya, 2024). The Rambutan Palm Oil Mill currently requires improvements in environmental conditions so that workers become more aware, compliant, and active in maintaining occupational safety. The workplace safety climate has a highly significant influence on worker behavior. The two main indicators of this behavior include compliance with regulations—such as using PPE and following SOPs—and active involvement in OHS programs, such as incident reporting (Neal & Griffin, 2004).

A favorable corporate safety climate significantly drives workers' level of compliance with regulations (Syed-Yahya et al., 2022). The use of personal protective equipment (PPE) and adherence to work procedures are tangible reflections of this safety perception (Wijaya et al., 2024). PKS Rambutan still faces behavioral obstacles where workers do not always use PPE and have not fully followed the applicable SOPs. This suboptimal compliance level indicates a gap in safety implementation in the field.

A conducive safety condition also triggers workers to be more actively involved in reporting hazards and participating in other safety activities (Abegaz, 2025; Ansori et al., 2021). Workers at PKS Rambutan currently rarely report hazardous incidents and are not yet actively involved in available safety programs. This low level of involvement indicates that safety performance at PKS Rambutan still requires continuous improvement efforts.

The Rambutan Palm Oil Mill is a strategic unit of PT Perkebunan Nusantara IV Regional I, located in Tebing Tinggi, North Sumatra, focusing on processing fresh fruit bunches (FFB) into crude palm oil (CPO) and palm kernel. In achieving production targets, the company integrates sustainability principles by placing Occupational Health and Safety (OHS) as a core pillar for smooth operational continuity.

The Rambutan Palm Oil Mill already has safety policies and facilities, such as safe work SOPs, PPE provision, and the establishment of an OHS Committee; however, their implementation has not been optimal. Administratively, the company records a zero-accident status, but the reality in the field reveals hazardous incidents (near-misses) that go unreported by workers. The absence of a clear, practical, and accessible reporting system worsens this condition, including the unavailability of reporting forms and dedicated communication channels. Workers tend to be reluctant to report, viewing it as a complicated process that potentially interferes with production targets. Consequently, a silent culture has formed, preventing potential hazards from being systematically identified and addressed by management.

Unsafe behaviors are still observed, such as not wearing complete PPE, ignoring SOPs, and low participation in safety activities. Workers prioritize production targets over safety. Safety communication does not flow openly and is limited only to morning roll calls without effective safety briefings. Technical supervision is suboptimal due to a lack of direct inspections into high-risk areas by leadership. Weak supervision and the absence of firm disciplinary action cause safety violations to recur. Ultimately, safety regulations are often viewed

as a formality rather than a necessity that must be obeyed.

The results of an initial survey conducted among 30 workers at the Rambutan Palm Oil Mill showed that management commitment to occupational safety has not been consistent; 12 workers (40%) felt the company cared due to written regulations, while 18 workers (60%) assessed that leadership had not shown tangible concern in day-to-day supervision. Workers observed that supervision over PPE usage remains very loose at the mill, and workers who violate rules are rarely reprimanded firmly, creating the impression that safety regulations are merely a formality.

Regarding safety communication in conveying information about occupational safety, 14 workers (46.7%) stated that safety information had been provided, usually through pre-work briefings. However, 16 workers (53.3%) felt that this communication was still ineffective, as it often took the form of brief announcements during morning roll calls without deep explanations regarding specific hazards at each workstation. This condition fuels the perception among workers that safety rules are nothing more than a formality.

The practice of the occupational safety system in this company still faces various obstacles regarding facilities and procedural implementation; 14 workers (46.7%) stated that standard operating procedures (SOPs) were available, while 16 workers (53.3%) complained about the incomplete and substandard condition of safety equipment. Equipment inspections are not conducted routinely, keeping the potential risk from damaged tools high. Workers frequently ignore SOPs to chase production speed targets. Physical discomfort when wearing PPE in hot factory areas further exacerbates the level of worker compliance in the field.

Safety training is the aspect that requires the most attention, as 19 workers (63.3%) stated that there is almost an absolute absence of specialized training or refresher courses regarding occupational safety. As a result, many workers do not fully understand emergency response protocols or the correct way to use protective equipment. This limited knowledge increases the risk of work accidents, as workers tend to rely on habit rather than established procedures.

These conditions highlight a gap between the administratively established occupational safety system and the implementation of worker safety behavior in the field. This gap indicates that the safety climate at the Rambutan Palm Oil Mill (PKS Rambutan) has not been optimally formed, thereby impacting low occupational safety performance. The primary problem lies in the suboptimal safety climate in shaping safe working behavior. Therefore, the author is interested in investigating further the influence of safety climate as a determinant of occupational safety performance among workers at the Rambutan Palm Oil Mill.

METHODS

The type of research used in this study is quantitative, utilizing a cross-sectional design where both dependent and independent variables are measured simultaneously. The independent variable in this study is safety climate, while the dependent variable is safety performance. This study has obtained ethical approval from the Health Research Ethics Committee of Universitas Sumatera Utara under protocol number: 2605424-KEPK-USU.

The research was conducted at PT. Perkebunan Nusantara IV Regional I, specifically at the Rambutan Palm Oil Mill (1PRB) located in Paya Bagas Village, Tebing Tinggi District, Serdang Bedagai Regency, North Sumatra Province, approximately 80 km southeast of Medan City. The study was carried out from March 2026 until completion.

The population in this study consisted of all workers at the Rambutan Palm Oil Mill, totaling 137 individuals. Sampling in this study utilized purposive sampling, which is a technique for determining samples based on specific considerations or criteria. The sample established for this study consisted of workers who are part of the operational work units and possess a high potential risk of hazards, with a total sample size of 88 workers from the processing, sorting, and engineering departments.

In this study, the researcher examines two main variables: the independent variable, which is safety climate (comprising management commitment, safety communication, safety practices, and safety training), and the dependent variable, which is occupational safety performance.

Data collection methods in this study were conducted using both primary and secondary data. Primary data were obtained through observation and direct interviews with workers using a questionnaire. The questionnaire contained questions regarding each research variable, including worker characteristics (age, tenure, and education level) and specific data for each variable (safety climate and safety performance). Secondary data were obtained from corporate management, the head of the P2K3 (Occupational Safety and Health Committee) department, and other relevant parties. Additionally, data were gathered from literature such as books, internet sources, and scientific papers regarding safety climate and safety performance.

The instruments used in this study include writing tools, a camera, and questionnaires. The safety performance variable instrument was measured using a questionnaire regarding safety compliance (workers' adherence to safety procedures) and safety participation (workers' active involvement in supporting occupational safety within the organization). The safety climate variable was measured using a questionnaire that assesses four main dimensions: management commitment, safety communication, safety practices, and safety training.

Data processing was performed through manual and computerized methods, which involved: **Editing (d**ata processing conducted to check the correctness and completeness of the questionnaires). **Coding** (conducted after data were obtained and edited, where the researcher assigned numbers to each question to facilitate the subsequent data analysis). **Entry** (the activity of inputting data into a computer program to obtain results and conclusions). **Cleaning Data** (reviewing all data inputted into the computer to avoid errors during data entry).

Data analysis is a crucial stage in research because raw data do not necessarily provide clear information immediately. Therefore, a processing stage through univariate, bivariate, and multivariate analysis is required to derive meaning from the collected data.

Univariate Analysis: Univariate analysis aims to illustrate or describe the characteristics of each research variable (Notoatmodjo, 2018). The results of this analysis are presented in the form of frequency distributions and percentages for each variable. In this study, univariate analysis is used to examine the variables under study, namely safety climate and safety performance.

Bivariate Analysis: Bivariate analysis is conducted to determine whether there is an association between the independent and dependent variables. Data processing was carried out with the assistance of a computer program using the Chi-square test, presented in the form of frequency distribution tables and narrative descriptions. Statistical test results are declared significant if the p-value < 0,05. In addition, the strength of the association between the independent and dependent variables can be observed through the Odds Ratio (OR) value.

Multivariate Analysis: Multivariate analysis is used to examine the simultaneous effect of several variables on other variables (Notoatmodjo, 2018). In this study, multivariate analysis aims to determine the effect of the independent variables (safety climate) on the dependent variable (safety performance).

Multivariate analysis was performed using the binary logistic regression testing to evaluate the simultaneous effect and the strength of the relationship between variables. The analysis stage began with a bivariate test to screen candidate variables. Variables with a p-value ≤0,25 were entered into the multivariate model. Subsequently, multiple logistic regression modeling was conducted, and variables were declared significant if they had a p-value < 0,05. Through the Odds Ratio (OR) value, the researcher can predict how likely a worker is to have good safety performance based on its driving factors.

RESULTS

1. Univariate Analysis

Univariate analysis was utilized to examine the demographic characteristics of the respondents and the frequency distribution of each research variable, including age, tenure, education level, management commitment, safety communication, safety practices, safety training, and safety performance.

Characteristics of Respondents

Table 1. Frequency Distribution of Respondents Based on Age, Tenure, and Education Level at Rambutan Palm Oil Mill

Respondent Characteristics	Frequency (n)	Percentage (%)
Age		
< 41 years old	43	48,9
≥ 41 years old	45	51,1
Tenure		
< 5 years	1	1,1
≥ 5 years	87	98,9
Education Level		
Elementary School (SD)	1	1,1
High School/Vocational School (SMA/SMK)	79	89,8
Diploma III (D3)	2	2,3
Banchelor\s Degree (S1)	6	6,8

The total number of respondents in this study was 88 workers. The majority of the workers were aged ≥41 years, accounting for 45 workers (51.1%), while those aged <41 years accounted for 43 workers (48.9%). Based on job tenure, the vast majority of respondents had a tenure of age ≥5 years, totaling 87 workers (98.9%), whereas only 1 worker (1.1%) had a tenure of <5 years. In terms of education level, it was found that the largest group of respondents consisted of those with a high school education or equivalent, totaling 79 workers (89.8%). Respondents holding a Bachelor's degree (S1) accounted for 6 workers (6.8%), followed by those with a Diploma III (D3) degree, totaling 2 workers (2.3%), and the remaining 1 worker (1.1%) had an elementary school education as their highest level of completed education.

Distribution of Research Variables

Table 2. Categorization Distribution of Research Variables Among Workers at Rambutan Palm Oil Mill

No	Variable	Category	n	%
1.	Mangement Commitment	Good	42	47,7
		Poor	46	52,3
2.	Safety Comunication	Good	38	43,2
		Poor	50	56,8
3.	Safety Practices	Good	36	40,9
		Poor	52	59,1
4.	Safety Training	Good	42	47,7
		Poor	46	52,3
5.	Safety Climate	Good	37	42,0

		Poor	51	58,0
6.	Safety Performance	Good	38	43,2
		Poor	50	56,8
Total			88	100,0

The research variables evaluated in this study include management commitment, safety communication, safety practices, safety training, and safety performance.

Distribution of Management Commitment Variable: Management commitment is divided into two categories: "Good" and "Poor". Based on the management commitment assessed among workers at the Rambutan Palm Oil Mill, it was found that the implemented management commitment was categorized as "Good" for 42 individuals (47.7%) and "Poor" for 46 individuals (52.3%).

Distribution of Safety Communication Variable: Safety communication among workers at the Rambutan Palm Oil Mill was categorized into "Good" and "Poor," relating to all communication activities carried out by workers regarding their respective safety during work. Based on the communication practice of the workers, 38 individuals (43.2%) were declared "Good," and 50 individuals (56.8%) were declared "Poor".

Distribution of Safety Practices Variable: Regarding the safety practices carried out by the workers, it was found that 36 workers (40.9%) exhibited "Good" safety practices, while 52 workers (59.1%) exhibited "Poor" safety practices.

Distribution of Safety Training Variable: Safety training for workers at the Rambutan Palm Oil Mill was categorized into "Good" and "Poor," covering all activities and training undergone by workers concerning their safety while working. For this variable, the results showed that 42 individuals (47.7%) had "Good" safety training, and 46 individuals (52.3%) had "Poor" safety training.

Distribution of Safety Climate Variable: Safety climate among workers at the Rambutan Palm Oil Mill was categorized into "Good" and "Poor," encompassing all matters and activities performed by workers regarding their workplace safety. The results for the safety climate variable indicated that 37 individuals (42.0%) perceived a "Good" safety climate, while 51 individuals (58.0%) perceived a "Poor" safety climate.

Distribution of Safety Performance Variable: Based on the safety performance assessment of the 88 workers, it was found that 38 individuals (43.2%) demonstrated "Good" safety performance, and 50 individuals (56.8%) demonstrated "Poor" safety performance

Bivariate Analysis

The bivariate analysis in this study was conducted using the Chi-square test. The analytical results are presented in the following tables.

Table 3. Influence of Management Commitment on Safety Performance Among Workers at Rambutan Palm Oil Mill

No.	Management Commitment	Safety Performance				Total		*P-Value*
		Good		Poor				
		n	%	N	%	n	%	
1.	Good	23	54,8	19	45,2	42	100,0	0,036
2.	Poor	15	32,6	31	67,4	46	100,0	

The research findings from the 88 workers indicated that respondents with good management commitment had a higher distribution of good safety performance, namely 23 individuals (54.8%), while those with poor safety performance numbered 19 individuals (45.2%). For respondents with poor management commitment, the majority also had poor safety performance, totaling 31 individuals (67.4%), while 15 individuals (32.6%) had good safety performance. The statistical test showed a p-value of 0.036 ($p < 0.05$), confirming that management commitment significantly influences worker safety performance. This indicates that management commitment is a crucial factor affecting occupational safety performance.

Table 4. Influence of Safety Communication on Safety Performance Among Workers at Rambutan Palm Oil Mill

No.	Safety Communication	Safety Performance				Total		*P-Value*
		Good		Poor				
		n	%	n	%	n	%	
1.	Good	21	53,8	18	46,2	39	100,0	0,002
2.	Poor	10	20,4	39	79,6	49	100,0	

The results showed that respondents with good safety communication were more likely to exhibit good safety performance, accounting for 23 individuals (54.8%), whereas 19 individuals (45.2%) had poor safety performance. For respondents with poor safety communication, the majority demonstrated poor safety performance, totaling 31 individuals (67.4%), while only 15 individuals (32.6%) had good safety performance. The statistical test revealed a p-value of 0,002 ($p < 0,05$), showing that safety communication has a significant influence on workers' safety performance. This underscores that effective safety communication supports the improvement of occupational safety performance.

Table 5. Influence of Safety Practices on Safety Performance Among Workers at Rambutan Palm Oil Mill

No.	Safety Practices	Safety Performance				Total		*P-Value*
		Good		Poor				
		n	%	n	%	n	%	
1.	Good	23	63,9	13	36,1	36	100,0	0,001
2.	Poor	15	28,8	37	71,2	52	100,0	

The research demonstrated that respondents with good safety practices were more likely to achieve good safety performance, totaling 23 individuals (63.9%), while 13 individuals (36.1%) had poor safety performance. On the other hand, the majority of respondents with poor safety practices exhibited poor safety performance, amounting to 37 individuals (71.2%), with only 15 individuals (24.1%) maintaining good safety performance. The statistical analysis indicated a p-value of 0,001 ($p < 0.05$), meaning safety practices significantly affect workers' safety performance.

Table 6. Influence of Safety Training on Safety Performance Among Workers at Rambutan Palm Oil Mill

No.	Safety Training	Safety Performance				Total		*P-Value*
		Good		Poor				
		n	%	n	%	n	%	
1.	Good	27	64,3	15	35,7	42	100,0	<0,001
2.	Poor	11	23,9	35	76,1	46	100,0	

The results among the 88 workers showed that respondents with good safety training had higher rates of good safety performance, totaling 27 individuals (64.3%), whereas 15 individuals (35.7%) had poor safety performance. Conversely, the majority of respondents with poor safety training experienced poor safety performance, amounting to 43 individuals (74.1%), while 15 individuals (25.9%) had good safety performance. The statistical test yielded a p-value of <0.001 (p <0.05), indicating that safety training significantly influences workers' safety performance. This demonstrates that high-quality safety training is instrumental in enhancing safety performance.

Table 7. Influence of Safety Climate on Safety Performance Among Workers at Rambutan Palm Oil Mill

No.	Safety Climate	Safety Performance				Total		*P-Value*
		Good		Poor				
		n	%	n	%	N	%	
1.	Good	26	70,3	11	29,7	37	100,0	<0,001
2.	Poor	12	23,5	39	76,5	51	100,0	

Based on the research conducted on 88 workers, it was found that respondents who perceived a good safety climate were more likely to have good safety performance, specifically 26 individuals (70.3%), while 11 individuals (29.7%) had poor safety performance. Conversely, among respondents who perceived a poor safety climate, the majority had poor safety performance, totaling 39 individuals (76.5%), while only 12 individuals (23.5%) demonstrated good safety performance. The statistical test yielded a p-value <0.001 (p <0.05), indicating that safety climate has a highly significant influence on workers' safety performance.

Multivariate Analysis

Multivariate analysis in this study used the binary logistic regression test to determine the most dominant variable influencing workers' safety performance. The variables analyzed in the first stage included management commitment, safety communication, safety practices, and safety training. All variables were entered into the model because they met the selection criteria based on the results of the bivariate analysis with a p-value <0.25.

Table 8. Multivariate Analysis Results

Variable	B	*p-value*	OR	95% C.I.	
				Lower	*Upper*
Stage 1					
Management Commitment	0,702	0,185	0,457	0,714	5,705

Safety Communication	1,200	0,021	5,606	1,199	9,192
Safety Practices	0,871	0,102	3,860	0,841	6,792
Safety Training	1,597	0,002	2,667	1,763	13,827
Stage 2					
Safety Communication	1,249	0,015	3,487	1,272	9,561
Safety Practices	1,023	0,048	2,780	1,007	7,678
Safety Training	1,521	0,003	4,575	1,675	12,494
Constant	-2,036	<0,001	0,131		

The results of the first-stage analysis showed that safety communication and safety training had a significant effect on workers' safety performance. Safety communication had a p-value = 0.021 with an OR of 5.606, while safety training had a p-value = 0.002 with an OR of 2.667. Management commitment and safety training did not show a significant influence in the first stage because they had a p-value > 0.05; however, these variables were still retained in the model because they were assessed to have theoretical and statistical relevance.

The second-stage analysis after the variable selection process showed that safety communication, safety practices, and safety training had a significant effect on workers' safety performance. Safety training became the most dominant variable with an OR value of 4.575. These results indicate that workers with poor safety training are 4.575 times more likely to have poor safety performance compared to workers with good safety training.

Safety communication also had a significant effect on safety performance with an OR value of 3.487. This result shows that workers with poor safety communication have a 3.487 times greater risk of having poor safety performance compared to workers with good safety communication. Safety practices had an OR value of 2.780, which means that workers with poor safety practices are 2.780 times more likely to experience poor safety performance compared to workers who receive good safety practices.

The final model shows that safety communication, safety practices, and safety training contribute to the improvement of workers' safety performance. A constant value of -2.036 with p < 0.001 and an OR of 0.001 indicates that the probability of poor safety performance will decrease if workers have good safety communication, safety practices, and safety training. The results of this study confirm the importance of implementing effective safety communication, consistent safety practices, and continuous safety training in improving occupational safety performance.

Based on the statistical output above, the multiple logistic regression equation model to predict the influence of safety communication, safety practices, and safety training on workers' safety performance is as follows.

$$p(y) = \frac{1}{1 + e^{-(\propto + \beta 1 \chi 1 + \beta 2 \chi 2 + \cdots + \beta i \chi i)}}$$

Notes:

$p(y)$ = probability of safety performance occurrence

e = natural number (2,718)

α = constant

β = regression coefficient

x = independent variable

$$p(y) = \frac{1}{1 + e^{-(\propto + \beta 1 \chi 1 + \beta 2 \chi 2 + \cdots + \beta i \chi i)}}$$

$$p(y) = \frac{1}{1 + e^{-(-2{,}036+1{,}249+1{,}023+1{,}521)}}$$

$$p(y) = \frac{1}{1 + 2{,}718^{-(1{,}757)}}$$

$$p(y) = \frac{1}{1{,}1726}$$

$$p(y) = 0.8528 = 85.3\%$$

The equation above indicates that the probability value is 85.3 percent, which means that workers who have good safety communication, good safety practices, and good safety training have a 85.3 percent chance of achieving good safety performance, while the the chance of workers having poor safety performance is 14.7 percent.

DISCUSSION

The Influence of Management Commitment on Occupational Safety Performance among Workers at Rambutan Palm Oil Mill

In this study, an analysis was conducted to examine the extent to which this commitment is related to the safety performance of operational workers (processing, engineering, and sorting) at the Rambutan Palm Oil Mill. The successful implementation of occupational safety in the workplace is heavily influenced by management's support and commitment to creating a safe and healthy working environment (Suma'mur, 2020). Based on the safety performance model (Griffin & Neal, 2000), management commitment plays a vital role as the primary pillar shaping the organizational safety climate that directs occupational safety priorities.

Based on the results of the chi-square test conducted in this study, a significant value (*p*-value) of 0.040 was obtained, indicating a statistically significant relationship or influence between management commitment and the safety performance of workers at the Rambutan Palm Oil Mill. This *p*-value is smaller than the significance threshold (α= 0,05). When analyzed further t hrough the first-stage logistic regression test, it was found that management commitment had a *p*-value of 0.185 (ρ>0,05) meaning it did not become the most dominant simultaneous predictor. This implies that although it has a significant influence bivariately, the relationship is not dominant enough when tested alongside other safety climate variables in the multivariate model. Consequently, management commitment has a positive influence, but its contribution weakens if it is not supported by daily technical interaction factors in the field.

The results of this study are in line with a study conducted by (Setiono, 2024), which examined the influence of top management commitment on workers' compliance behavior in the manufacturing industry. The results showed that management commitment written in formal policies is often perceived as ordinary by operational workers if it is not translated into tangible supervision. Similarly, a study by (Pratama & Sukmono, 2023) in the palm oil industry also emphasized that leadership commitment must be manifested in concrete actions, rather than merely fulfilling SMK3 (Occupational Safety and Health Management System) certification documents.

The Influence of Safety Communication on Occupational Safety Performance among Workers at Rambutan Palm Oil Mill

In this study, an analysis was conducted to see the extent to which this communication is related to the safety performance of operational workers at the Rambutan Palm Oil Mill. Efforts made based on safety communication to help improve occupational safety performance include conducting routine safety briefings before work shifts begin, disseminating potential hazard information through notice boards or OHS signs, and providing hazard reporting channels. Safety communication is also manifested through open dialogue between supervisors and workers regarding technical constraints, delivering educational reprimands for rule violations, and periodic discussions to evaluate near-miss incidents.

Based on the results of the chi-square test conducted in this study, a significant value (*p*-value) of 0.001 was obtained, showing a statistically significant relationship or influence between safety communication and the safety performance of workers at the Rambutan Palm Oil Mill. This *p*-value is smaller than the significance threshold (α= 0,05). When its relationship was analyzed multivariately using the final-stage multiple logistic regression test, the safety communication variable proved to be the second most dominant predictor with a *p*-value of 0.015 and an Odds Ratio (OR) value of 3.487. This means that workers with poor safety communication have a 3.487 times greater risk of having poor safety performance compared to workers with good safety

practices. This relationship is highly robust and statistically valid. Consequently, safety communication exert a significant positive influence in binding workers' concrete actions to act safely within the context of these data.

The results of this study align with research conducted by (Wijaya, 2024), which states that openness in hazard reporting and prompt responses from superiors establish a conducive communication climate for the formation of safety compliance. Routine safety dialogues at the beginning of work shifts (safety briefings) have proven effective in improving workers' accuracy in adhering to safe work procedures (Kines et al., 2021). The clarity of verbal safety instructions is capable of mitigating work error risks among processing machine operators, particularly in industrial environments with fast-changing risk dynamics (Sari & Ramadan, 2022).

The Influence of Safety Practices on Occupational Safety Performance among Workers at Rambutan Palm Oil Mill

In this study, the analysis was conducted to see the extent to which these practices are related to the safety performance of operational workers at the Rambutan Palm Oil Mill. Based on the safety performance model, safety practices play a vital role as a tangible manifestation or realization of the organization's written OHS policies, directly perceived by workers through daily routines on the production floor (Griffin & Neal, 2000).

Efforts made based on safety practices to help improve occupational safety performance include conducting regular workplace inspections, maintaining and calibrating machine safety barricades, and providing adequate sanitation and evacuation facilities. Safety practices are also manifested through strict supervision of PPE compliance, providing safety data sheet guidelines for chemicals in the laboratory, and swift handling of crude palm oil (CPO) spills that could potentially cause workers to slip. The standardization of these operational actions serves to create a safe physical working environment for workers.

Based on the results of the chi-square test conducted in this study, a significant value (*p*-value) of 0.011 was obtained, indicating a statistically significant relationship or influence between safety practices and the safety performance of workers at the Rambutan Palm Oil Mill. This *p*-value is smaller than the significance threshold (α= 0,05). When its relationship was analyzed simultaneously in the final-stage multiple logistic regression model, the safety practices variable proved to be the "third most dominant predictor" with a *p*-value of 0.048 and an Odds Ratio (OR) value of 2.780. This means that workers with poor safety practices are 2.780 times more likely to exhibit poor safety performance compared to workers who receive proper practices. This relationship is statistically significant and valid. Therefore, safety training exerts a clear positive influence in affecting workers' decisions to act safely within the context of these data.

The results of this study are in line with research conducted by (Kumar et al., 2025), which evaluated the implementation of physical OHS practices in the palm oil processing industry. The findings indicate that workers' decisions to comply with OHS regulations in the field are more heavily influenced by workplace organization (housekeeping) and the consistency of technical facility improvements. This is consistent with a study by (Wahyuni et al., 2023), which states that occupational safety practices have a significant influence on the safety behavior and occupational safety performance of industrial workers. The better the implementation of safety practices, the better the workers' compliance with safety procedures. Even though supervisors provide work instructions, the influence of tangible protective practices is far more dominant because it establishes physical boundaries that prevent unsafe acts. In processing industry areas, workers tend to neglect safety if floor conditions are left slippery and machine safety barricades are not securely installed.

The Influence of Safety Training on Occupational Safety Performance among Workers at Rambutan Palm Oil Mill

In this study, the analysis was conducted to see the extent to which this training is related to workers' decisions to act safely while performing operational duties at the Rambutan Palm Oil Mill. Based on the safety performance model, safety training plays an important role as the organization's primary means to transform formal policies into capabilities, skills, and fundamental cognitive assets for workers to recognize and mitigate risks (Griffin & Neal, 2000).

Efforts to enhance the effectiveness of safety training can be achieved through regular training execution, delivering easily understandable material, direct hands-on practice in the field, and evaluating

workers' comprehension after the training is conducted. Good safety training can help workers understand occupational hazard risks and enhance their ability to implement safe working behaviors. Furthermore, safety training can foster a positive occupational safety culture as workers become more conscious of the importance of workplace safety while executing their tasks.

Based on the results of the chi-square test conducted in this study, a significant value (*p*-value) of 0.020 was obtained, indicating a statistically significant relationship or influence between safety training and the safety performance of workers at the Rambutan Palm Oil Mill. This *p*-value is smaller than the significance threshold (α= 0,05). When its relationship was analyzed multivariately using the second-stage binary logistic regression, the safety training variable was proven to be the dominant predictor with a *p*-value of 0.003 and an Odds Ratio (OR) value of 4.575. This means that workers with poor safety training have a 4.575 times greater risk of having poor safety performance compared to workers with good safety training. This relationship is highly robust and statistically significant. Therefore, safety training has a highly dominant positive influence in affecting workers' decisions to act safely within the context of these data.

The results of this study are in line with research conducted by (Rahdiana et al., 2024), which confirmed that periodic safety training effectively transforms regulatory understanding into concrete safety actions in the field. Even though the program is run on a limited operational scale, the provision of tactical knowledge has been proven capable of boosting workers' confidence to refuse performing unsafe acts (Basahel, 2021). Interactively designed safety training has also been shown to increase voluntary participation initiatives (safety participation) among workers on the production floor (Robson et al., 2022).

The Influence of Safety Climate on Occupational Safety Performance among Workers at Rambutan Palm Oil Mill

In this study, an analysis was conducted to evaluate the extent to which the overall safety climate is related to the safety performance of operational workers (processing, engineering, and sorting sections) at the Rambutan Palm Oil Mill. The results of the Chi-square test showed a significance value (*p*-value) below the threshold ($\alpha = 0.05$). This statistically proves that there is a significant relationship or influence between the global safety climate and the safety performance of workers at the Rambutan Palm Oil Mill.

Further analysis using the logistic regression test revealed that the safety climate has a strong predictive value because it represents the accumulative reflection of its underlying variables in the field. This finding indicates that both bivariately and multivariately, safety climate plays a crucial role. Its contribution to workers' occupational safety performance will remain optimal if all its constituting dimensions—such as the clarity of operational risk communication and the effectiveness of Occupational Health and Safety (OHS) training—are strongly integrated and do not operate partially in the field.

This finding is in line with a study by Nahrudin and Wijaya (2023) regarding the influence of occupational safety climate on employee safety performance in the agro-industrial sector. The study showed that an unfavorable safety climate in the production area directly triggers a decrease in workers' discipline regarding the use of Personal Protective Equipment (PPE) and compliance with formal Standard Operating Procedures (SOPs). Similarly, Hidayat and Santoso (2022) in their study in the palm oil processing industry emphasized that collective perceptions of safety climate must be built consistently across every line of work. This step is vital to ensure that OHS values do not merely become rigid regulations on paper but are deeply embedded as workers' daily behaviors.

Based on the perception analysis regarding the safety climate at the Rambutan Palm Oil Mill, the majority of workers stated that the socialization of formal safety rules has been widely publicized through various OHS media. Nevertheless, there are dynamics in the field where workers feel that the safety atmosphere tends to weaken when faced with the pressure of high processing capacity targets, reaching 30 tons per hour. The workers expressed that operational constraints, such as delayed responses to facility damage reports or the implementation of OHS refresher material perceived as a mere formality during morning briefings, force them to prioritize completing daily production targets even though the workplace protection conditions are not yet fully ideal. This phenomenon demonstrates that workers strongly expect an overall

reinforcement of the safety climate that tangibly touches upon daily technical operational aspects.

The Most Dominant Safety Climate Factor Influencing Occupational Safety Performance among Workers at Rambutan Palm Oil Mill

Multivariate analysis used the binary logistic regression test with the Backward Likelihood Ratio (Backward LR) method to filter the four dimensions of safety climate (management commitment, safety communication, safety practices, and safety training) to identify which factor most strongly determines the optimal safety performance of operational workers at the Rambutan Palm Oil Mill.

Based on the results of the first-stage binary logistic regression test, all variables were entered into the model, yielding *p*-values of 0.185 for management commitment, 0.021 for safety communication, 0.102 for safety practices, and 0.002 for safety training. Given that the management commitment variable had the largest *p*-value and fell above the significance threshold (p>0.05), the Backward LR method eliminated this variable in the second stage. The results of the second-stage (final) test showed that the safety training variable proved to be the most dominant factor influencing occupational safety performance, with a significance value of 0.003 and the highest Odds Ratio (OR) value of 4.575.

The obtained Odds Ratio (OR) indicates that workers who perceive safety training to be poor have a 4.575 times greater risk or tendency to exhibit poor safety performance as well, compared to workers who receive good safety training. The next dominant variables constituting the final model are safety communication with an OR value of 3.487 (*p*-value = 0.015) and safety practices with an OR value of 2.780 (*p*-value = 0.048). Simultaneously, the combination of these three safety climate predictors yields a combined probability value of 85.3 percent for achieving good safety performance, while the the chance of workers having poor safety performance is 14.7 percent.

The high dominance value of the safety training variable theoretically proves that daily verbal interactions between supervisors and workers on the production area play the most crucial role for operational workers at the Rambutan Palm Oil Mill. Open dissemination of hazard information, clear verbal work instructions from foremen, and smooth two-way dialogue are capable of instantly removing procedural ambiguity without passing through complex psychological mediator pathways (Burke et al., 2006). A smooth flow of safety communication has proven effective in directly mitigating the risk of unsafe acts in a palm oil industrial work environment characterized by fast-changing risk dynamics and high production capacity target pressures.

Although safety communication acts as the most dominant predictor factor, its field effectiveness will be further optimized if it is consistently supported by the implementation of physical safety practices on the factory floor and the provision of local hazard training programs. Therefore, OHS culture improvement interventions at the Rambutan Palm Oil Mill must prioritize reforming risk information delivery media in noisy workstation areas, activating responsive hazard reporting channels, and ensuring the openness of field supervisors in continuously responding to safety suggestions from workers to contribute significantly to enhancing employees' occupational safety performance.

CONCLUSION

This study involved 88 workers at the Rambutan Palm Oil Mill. Based on the results of data analysis and statistical testing, it can be concluded that there is a significant influence of the overall occupational safety climate on the safety performance of workers at the Rambutan Palm Oil Mill, with a p-value < 0.001.

The results for the management commitment variable proved to have a significant effect on occupational safety performance, with a p-value of 0.036. Furthermore, safety communication also had a significant effect on safety performance, with a p-value of 0.002. The statistical test results for the safety practices variable indicated a significant influence on occupational safety performance, with a p-value of 0.001. Similarly, safety training was found to have a significant effect on safety performance, with a p-value of <0.001.

The results of the multivariate analysis using binary logistic regression showed that safety training (p = 0.003; OR = 4.575; 95% CI = 1.675–12.494), safety communication (p = 0.015; OR = 3.487; 95% CI = 1.272–9.561), and safety practices (p = 0.048;

OR = 2.780; 95% CI = 1.007–7678) have a significant influence on workers' safety performance.

The most dominant variable influencing safety performance is safety training, with an Odds Ratio (OR) value of 4.575. This result indicates that workers with poor safety training are 4.575 times more likely to experience poor safety performance compared to workers with good safety training. The resulting regression model indicates that workers who have good safety communication, good safety practices, and good safety training have a 85.3 percent chance of achieving good safety performance, while the the chance of workers having poor safety performance is 14.7 percent.

Future researchers are recommended to incorporate other variables related to occupational safety performance that have not been explored in this study, such as work supervision, organizational culture, work fatigue, job stress arising from factory production targets, the influence of reward and punishment systems, and working environment conditions. Furthermore, future studies are encouraged to employ alternative research methodologies, such as direct observation or a longitudinal study design, to provide a more comprehensive insight into the causal relationship between safety climate and occupational safety performance among industrial workers. This approach is essential for assessing actual behavioral changes in workers following the implementation of new OHS (Occupational Health and Safety) interventions or programs by management.

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