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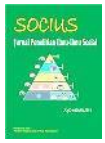

The Moderating Role of Safety Leadership in the Relationship Between Safety Climate, Safety Behavior, and Safety Performance: Evidence from the Palm Oil Processing Industry in Indragiri Hulu, Riau, Indonesia

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ABSTRACT
This study examines the moderating role of safety leadership behavior in the relationship between safety climate, safety behavior, and safety performance in the palm oil processing industry in Indragiri Hulu Regency, Riau, Indonesia. A quantitative approach was employed using data collected from 329 unit leaders across various operational divisions. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS to assess both direct and moderating effects. The findings reveal that safety climate has a positive and significant impact on safety performance, indicating that organizational commitment to safety and risk awareness are critical determinants of effective safety outcomes. In contrast, safety behavior does not show a significant direct effect on safety performance, suggesting that individual compliance and participation alone are insufficient without strong organizational support. Furthermore, safety leadership behavior is found to strengthen the relationship between safety climate and safety performance, highlighting the important role of leadership in reinforcing safety-related perceptions and practices. However, safety leadership behavior does not moderate the relationship between safety behavior and safety performance. These results contribute to the development of followership theory by emphasizing the interaction between leadership and employee roles in achieving organizational safety goals. The study underscores the importance of integrating strong safety leadership with a supportive safety climate to enhance safety performance in high-risk industrial settings.

INTRODUCTION

The role of workers within an organization is fundamental, as they serve as the primary drivers of operational success and long-term industrial sustainability. In labor-intensive sectors, such as the palm oil processing industry, employee contributions become even more critical due to the complexity and risks inherent in production processes. This study focuses on the palm oil processing industry producing Crude Palm Oil (CPO) located in Indragiri Hulu Regency, Riau Province, Indonesia. The selection of this context is grounded in the fact that Indonesia remains the world's largest producer of CPO, with Riau Province contributing the highest production share nationally.

Industrial activities in this sector are often accompanied by various occupational hazards that may threaten workers' safety and health conditions. Without adequate management, these risks can lead to workplace accidents, decreased productivity, and long-term organizational losses. Therefore, ensuring a safe and healthy work environment is not only a regulatory requirement but also a strategic necessity. Effective occupational safety management plays a key role in maintaining workforce well-being and operational continuity.

Workplace safety and health management aims to systematically anticipate, identify, evaluate, and control potential hazards that may arise during operational activities. These hazards include physical, chemical, and behavioral risks that can lead to occupational injuries,

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illnesses, discomfort, or reduced work efficiency. According to Suma'mur (1996:58), Occupational Safety and Health (OSH) encompasses a series of efforts designed to create a secure, comfortable, and conducive working environment for employees. Safety, in this context, refers to protective measures implemented to prevent accidents and injuries, while health emphasizes the absence of physical and psychological disorders related to work activities. Work itself is a dynamic process involving both physical and mental engagement aimed at achieving productive outcomes (Candrianto, 2020). Consequently, organizations must adopt proactive strategies to ensure that safety standards are consistently maintained. A failure to implement effective safety measures may result in increased accident rates and decreased employee morale. This highlights the importance of integrating safety into organizational practices and culture.

Recent statistical reports indicate a growing concern regarding workplace safety in Indonesia. Data released by the Social Security Administration Agency (BPJS Ketenagakerjaan) reveal a consistent increase in occupational accident cases over the past five years, from 2019 to 2024. This upward trend underscores the urgency of strengthening safety performance across various industries, including palm oil processing. Safety performance reflects the effectiveness of safety management systems in reducing accidents and ensuring compliance with safety regulations. Previous empirical studies have widely examined factors influencing safety performance, particularly safety climate. Research conducted by Aghaei et al. (2020), Asad et al. (2021), Chen et al. (2017), Prinasti and Fajrianthi (2018), Jusoh and Panatik (2016), Kundu et al. (2016), Manapragada (2018), Nadhim (2018), Putra et al. (2022), Sukamani et al. (2021), Wu et al. (2008, 2011), (Sakuroh et al., 2026), Kiyani et al. (2019), Abeje and Luo (2023), and (Susila et al., 2024) consistently demonstrate that safety climate significantly influences safety performance. These findings suggest that employees' perceptions of safety-related practices and policies play a crucial role in shaping their behavior. However, inconsistencies remain in the literature.

Contrary to the dominant findings, several studies have reported insignificant relationships between safety climate and safety performance. For instance, Shaheen et al. (2014), Glendon and Litherland (2001), and Gathmyr (2017) argue that safety climate does not directly impact safety performance. These conflicting results indicate the presence of potential moderating variables that may influence this relationship. One such variable is safety leadership behavior, which has gained increasing attention in recent years. Studies by Atkasari et al. (2022), (Marlina et al., 2024), Skeepersa and Mbohwa (2015), Supardi et al. (2021), Wu et al. (2008, 2011), Rusdiana (2020), and Agustina et al. (2019) highlight the significant role of leadership in enhancing safety performance. To date, there is limited evidence suggesting that safety leadership has no effect on safety performance, indicating its strong theoretical relevance. This study, therefore, seeks to address these inconsistencies by incorporating safety leadership as a moderating variable. Additionally, this research contributes to the development of followership theory, emphasizing the importance of employee roles in organizational success.

Followership theory provides a complementary perspective to leadership studies by emphasizing the role of employees in achieving organizational goals. Introduced by Robert Kelley in *In Praise of Followers* (1988), this theory highlights that organizational success is not solely dependent on leaders but also on the active participation of followers. Kelley (1992) defines followership as the ability and willingness of individuals to contribute effectively toward shared objectives. He further argues that leaders account for only 20% of organizational success, while followers contribute up to 80%. This perspective underscores the importance of employee engagement, responsibility, and proactive behavior in the workplace.

In the context of safety management, employees play a crucial role in implementing safety practices and maintaining compliance with established procedures. Therefore, understanding the interaction between leadership and followership becomes essential in improving safety performance. This study adopts this theoretical lens to examine how leadership behavior influences employee safety outcomes. Safety climate is generally understood as employees' shared perceptions regarding safety policies, procedures, and practices within an organization. A positive safety climate indicates that safety is prioritized and consistently reinforced by management. When employees perceive strong organizational commitment to safety, they are more likely to adhere to safety regulations and actively participate in safety-related activities.

Skeepers and Mbohwa (2015) describe safety performance as the overall effectiveness of safety practices, including training, supervision, accident reporting, and preventive measures (Hendriawan et al., 2026). A supportive safety climate fosters a sense of responsibility and awareness among employees, leading to improved safety outcomes. Conversely, a weak safety climate may result in negligence and increased accident rates. Although many studies confirm the positive relationship between safety climate and safety performance, inconsistencies in findings suggest the need for further investigation. This study, therefore, re-examines this relationship within the context of the palm oil industry.

In addition to safety climate, safety behavior is another critical factor influencing safety performance. Safety behavior refers to individual actions aimed at minimizing risks and preventing workplace accidents. These behaviors include compliance with safety regulations, proper use of protective equipment, and active participation in safety programs. According to Dessler (2005), workplace accidents are primarily caused by unsafe conditions and unsafe behaviors. Heinrich (2004) further emphasizes that approximately 88% of accidents result from unsafe actions performed by employees. This highlights the importance of fostering positive safety behavior among workers. Studies by Erickson (2000), Vredenburgh (2002), Garavan and O'Brien (2001), Nusantara and Rusdianti (2017), Asamani (2020), Atkasari et al. (2022), and Supardi et al. (2021) consistently demonstrate that improved safety behavior leads to better safety performance. Employees who adhere to safety procedures contribute significantly to reducing accident rates. Thus, promoting safety behavior is essential for achieving optimal safety outcomes.

Safety leadership behavior plays a pivotal role in shaping both safety climate and safety behavior within an organization. It is defined as the process by which leaders influence and motivate employees to prioritize safety in their work activities (Griffin and Hu, 2013; Lu and Yang, 2010). Over the past decades, research has highlighted the importance of leadership styles in improving safety outcomes (Jiang et al., 2024).

Effective leadership approaches, such as transformational and safety-oriented leadership, have been shown to enhance safety awareness, compliance, and participation (Barling et al., 2002). In contrast, ineffective leadership styles can hinder safety initiatives and increase accident risks (Kelloway et al., 2006; Nielsen et al., 2016). Leaders serve as role models whose actions and decisions communicate organizational priorities regarding safety. According to Latief et al. (2017), leadership behavior often has a stronger impact than formal policies in shaping safety practices. Therefore, understanding the moderating role of safety leadership is crucial for improving safety performance.

Despite extensive research on safety leadership, limited studies have examined its moderating role in the relationships between safety climate, safety behavior, and safety performance. Previous studies have primarily focused on its direct or mediating effects (Ariyadi

and Claudia, 2022; Wu et al., 2008, 2011). This indicates a significant research gap that warrants further exploration.

Moreover, the interaction between safety leadership and safety behavior remains underexplored, particularly in high-risk industries such as palm oil processing. Given the increasing rate of workplace accidents and the strategic importance of the palm oil sector in Indonesia, this study aims to provide empirical evidence on these relationships. Specifically, this research investigates how safety leadership behavior moderates the influence of safety climate and safety behavior on safety performance. By doing so, it contributes to both theoretical development and practical implications in occupational safety management. Ultimately, the findings are expected to support organizations in developing more effective safety strategies and leadership practices.

METHOD

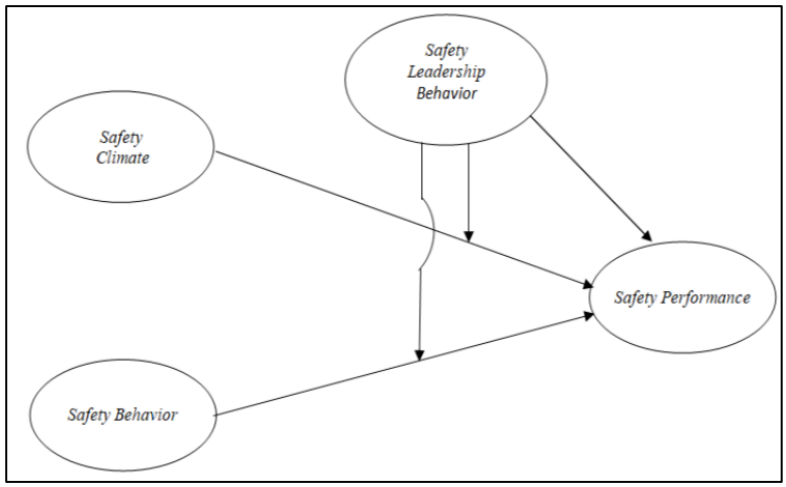


Figure 1. Conceptual Framework

This study adopts a quantitative research design to investigate the interrelationships among safety climate, safety behavior, safety leadership behavior, and safety performance within the palm oil processing industry in Indragiri Hulu Regency, Riau Province, Indonesia. The research specifically examines the moderating role of safety leadership behavior in influencing the effects of safety climate and safety behavior on safety performance, in line with the proposed research framework. The unit of analysis consists of organizational leaders at the operational level, reflecting their strategic role in shaping safety practices and influencing employee behavior.

A total of 329 respondents were included in the study, representing unit leaders from multiple functional divisions, including administration and operations, loading ramp, processing, laboratory, engineering and maintenance, as well as occupational health and safety (K3) and environmental management units. The study employs a saturated sampling technique, whereby all members of the population are selected as respondents, ensuring comprehensive coverage and minimizing sampling bias. Data were collected using structured questionnaires designed to capture perceptions and practices related to workplace safety. This approach allows for a systematic and objective assessment of the relationships among the studied variables.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS software, which is particularly suitable for examining complex models involving moderating variables and latent constructs. The measurement of safety

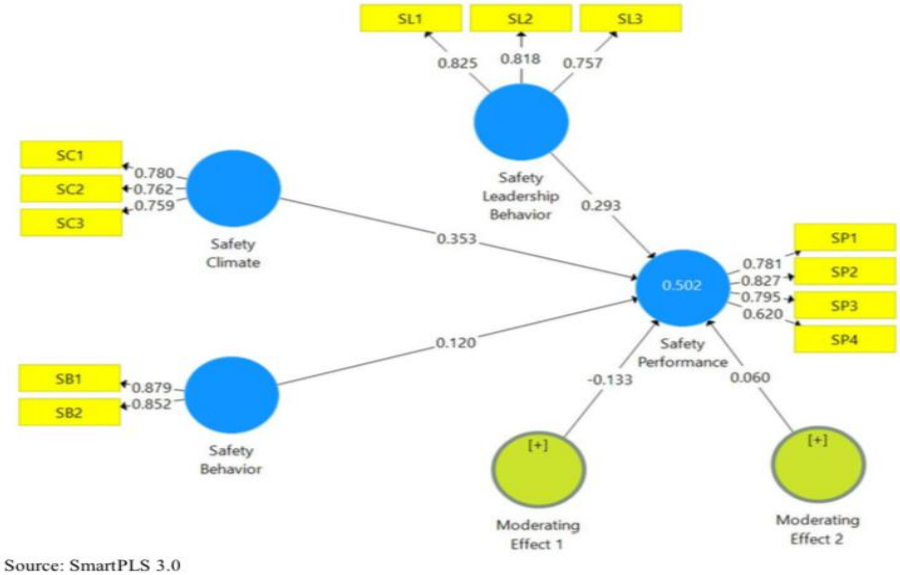
performance is based on the framework developed by Wu et al. (2011), encompassing key indicators such as safety inspection, accident investigation, safety training, and safety motivation. Safety climate is also measured using indicators adapted from Wu et al. (2011), including management commitment to safety, perceived risk, and emergency preparedness.

Meanwhile, safety behavior is operationalized following Lu and Yang et al. (2010), consisting of two primary dimensions: safety compliance and safety participation. Safety leadership behavior is measured using the indicators proposed by Wu et al. (2011), which include safety coaching, safety caring, and safety controlling. The use of these established measurement scales ensures the reliability and validity of the constructs under investigation. Furthermore, the PLS-SEM approach enables the assessment of both direct and moderating effects, providing a robust analytical framework to test the proposed hypotheses and generate empirical insights into safety management practices within the palm oil industry.

RESULT

The descriptive analysis indicates that the majority of respondents in this study are male employees, predominantly within the age range of 20 to 30 years old, and most possess a high school level of education or its equivalent. This demographic profile reflects the typical workforce composition in the palm oil processing industry, which is largely dominated by young and productive labor. In terms of variable assessment, safety performance is perceived to be at a high level, with safety inspection emerging as the most prominent indicator, while safety motivation appears as the relatively weakest dimension. This suggests that although routine safety checks are well implemented, internal motivational aspects toward safety may still require improvement. Furthermore, safety climate is also rated highly by respondents, particularly in terms of management commitment to safety, whereas emergency response readiness receives comparatively lower evaluation. Similarly, safety behavior demonstrates a high overall perception, with safety compliance being stronger than safety participation. Lastly, safety leadership behavior is assessed positively, where safety coaching is the most dominant aspect, while safety controlling is perceived as less optimal. These findings collectively indicate that although safety practices are generally well established, certain dimensions still require strategic enhancement.

Figure 2. Research Path Model



Source: SmartPLS 3.0

Measurement Model Analysis (Outer Model)

Convergent Validity

Table 1. Loading Factor

Variable/Indicator	Factor Loading
Safety Behavior (SB)	
Safety Compliance (SB1)	0.879
Safety Partisipation (B2)	0.852
Safety Climate (SC)	
Commitment to Safety (SC1)	0.780
Perceived Risk (SC2)	0.762
Emergency Respon (SC3)	0.759
Safety Leadership Behavior (SL)	
Safety Coaching (SL1)	0.825
Safety Caring (SL2)	0.818
Safety Controlling (SL3)	0.757
Safety Performance (SP)	
Safety Inspection (SP1)	0.781
Accident Investigation (SP2)	0.827
Safety Trainning (SP3)	0.795
Safety Motivation (SP4)	0.620

Sources: SmarPLS 3.3 Programs

The convergent validity assessment demonstrates that all measurement indicators meet the required threshold for factor loadings. Indicators with loading values below 0.5 were initially considered for elimination; however, after re-estimation, all retained indicators exhibit loading values exceeding 0.5. This confirms that each indicator has a strong correlation with its respective latent construct. Therefore, all variables included in this study are deemed valid in representing the constructs of safety climate, safety behavior, safety leadership behavior, and safety performance.

Discriminant Validity

Table 2. Discriminant Validity

	Moderating Effect 1	Moderating Effect 2	Safety Behavior	Safety Climate	Safety Leadership Behavior	Safety Perfor-mance
SB1	-0.130	-0.247	0.879	0.470	0.444	0.474
SB2	-0.165	-0.193	0.852	0.551	0.545	0.432
SC1	-0.233	-0.245	0.491	0.780	0.534	0.503
SC2	-0.153	-0.164	0.403	0.762	0.435	0.462
SC3	-0.212	-0.213	0.453	0.759	0.505	0.500
SL1	-0.173	-0.172	0.489	0.532	0.825	0.498
SL2	-0.225	-0.165	0.442	0.499	0.818	0.509
SL3	-0.155	-0.172	0.434	0.514	0.757	0.446
SP1	-0.157	-0.254	0.442	0.506	0.499	0.781
SP2	-0.163	-0.232	0.459	0.563	0.546	0.827
SP3	-0.165	-0.241	0.409	0.489	0.464	0.795
SP4	-0.165	-0.228	0.238	0.346	0.282	0.620
Safety Behavior * Safety Leadership Behavior	1.000	0.618	-0.170	-0.262	-0.232	-0.210
Safety Climate * Safety Leadership Behavior	0.618	1.000	-0.255	-0.272	-0.211	-0.311

Sources: SmarPLS 3.3 Programs

The discriminant validity test reveals that each indicator loads more strongly on its associated latent variable compared to other constructs. This is evidenced by higher cross-loading values for each respective variable, confirming that the constructs are empirically distinct from one another. Consequently, the measurement model satisfies the discriminant validity requirement, indicating that all constructs are well differentiated.

Construct Reliability

Table 3. Construct Reliability

	Composite Reliability	Average Variance Extracted (AVE)
Safety Behavior	0,857	0.750
Safety Climate	0,811	0.588
Safety Leadership_Behavior	0,842	0.641
Safety Performance	0,844	0.578

Sources: SmarPLS 3.3 Programs

The reliability analysis shows that all constructs achieve an Average Variance Extracted (AVE) value greater than 0.5 and Composite Reliability (CR) values exceeding 0.7. According to Hair et al. (2019), these thresholds indicate satisfactory internal consistency and reliability of the measurement model. Thus, all constructs in this study can be considered reliable and suitable for further structural model analysis.

Structural Model Analysis (Inner Model)

Coefficient of Determination (R^2)

Table 4. R-Square

Variabel	R Square
Safety climate	-
Safety behavior	-
Safety Performance	0,502

Sources: SmarPLS 3.3 Programs

The coefficient of determination analysis indicates that the R-square value for safety performance is 0.502. This implies that safety climate, safety behavior, and safety leadership behavior collectively explain 50.2% of the variance in safety performance. Based on the classification by Hair et al. (2019), this value falls within the moderate category. Therefore, while the model demonstrates a meaningful explanatory power, there remains a proportion of variance influenced by other external factors not included in this study.

Hypothesis Testing

Table 5. Hypothesis Testing

Hypothesis	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Description
Safety Climate -> Safety Performance	0.353	5.408	0.000	Hipotesis accepted
Safety Behavior -> Safety Performance	0.120	1.745	0.082	Hypothesis rejected
Moderating Effect 1 -> Safety Performance	-0.133	2.303	0.022	Hipotesis accepted
Moderating Effect 2 -> Safety Performance	0.060	0.970	0.332	Hypothesis rejected

Sources: SmarPLS 3.3 Programs

The first hypothesis, which posits that safety climate has a significant effect on safety performance, is supported. This is indicated by a p-value below 0.05 and a t-statistic exceeding 1.96.

This finding suggests that a stronger safety climate contributes positively to improving safety performance within the palm oil processing industry. The result is consistent with prior studies by Aghaei et al. (2020), Asad et al. (2021), Chen et al. (2017), Prinasti and Fajrianthi (2018), Jusoh and Panatik (2016), Kundu et al. (2016).

The second hypothesis, which examines the influence of safety behavior on safety performance, is not supported. The statistical results show a p-value greater than 0.05 and a t-

statistic below 1.96, indicating that safety behavior does not significantly affect safety performance. This finding aligns with previous studies conducted by Derman (2025), Aisyah and Yudiarso (2024), Sugma (2022), and Daud et al. (2021).

The third hypothesis, which proposes that safety leadership behavior moderates the relationship between safety climate and safety performance, is supported. The statistical results confirm that safety leadership behavior strengthens the effect of safety climate on safety performance, as indicated by a p-value less than 0.05 and a t-statistic above 1.96. This suggests that leadership plays a crucial role in enhancing the effectiveness of safety climate.

In contrast, the fourth hypothesis, which suggests that safety leadership behavior moderates the relationship between safety behavior and safety performance, is not supported. The results show that the moderating effect is not statistically significant, as indicated by a p-value greater than 0.05 and a t-statistic below 1.96. This implies that safety leadership behavior does not significantly influence the relationship between safety behavior and safety performance.

DISCUSSION

The findings of this study highlight the critical role of safety climate in enhancing safety performance within the palm oil processing industry. A positive safety climate reflects strong organizational commitment to safety, which influences employees' perceptions and behaviors in the workplace. When management consistently prioritizes safety through policies, communication, and practices, employees are more likely to internalize safety values and comply with safety procedures. This result supports prior empirical evidence demonstrating that safety climate is a key determinant of safety outcomes (Aghaei et al., 2020). In high-risk industries such as palm oil processing, a strong safety climate is essential to minimize accidents and improve operational efficiency. Therefore, organizations must continuously strengthen safety culture through leadership commitment and systematic safety management practices.

Interestingly, the study reveals that safety behavior does not significantly influence safety performance. This finding contrasts with many previous studies that emphasize the importance of individual safety actions in reducing workplace accidents. One possible explanation is that safety behavior alone may not be sufficient to improve safety outcomes without strong organizational support and effective safety systems. Employees may comply with safety procedures; however, if organizational structures, supervision, or resources are inadequate, the impact on safety performance may be limited. This result is consistent with findings by Derman (2025) and Daud et al. (2021), suggesting that contextual factors play a crucial role in determining the effectiveness of safety behavior. Thus, organizations should not rely solely on individual behavior but also focus on strengthening systemic safety management (Marlina, 2024).

The moderating role of safety leadership behavior in the relationship between safety climate and safety performance provides significant insights. The results indicate that leadership enhances the influence of safety climate on safety performance, suggesting that leaders act as catalysts in translating safety values into practice. Leaders who actively promote safety through coaching, communication, and role modeling can reinforce employees' perceptions of safety importance. This finding aligns with Griffin and Hu (2013) and Lu and Yang (2010), who emphasize that leadership behavior is essential in shaping safety outcomes. Effective safety leadership ensures that safety policies are not only implemented but also internalized by employees, thereby improving overall safety performance.

However, the absence of a moderating effect of safety leadership behavior on the relationship between safety behavior and safety performance indicates a more complex interaction. This suggests that leadership may have a limited role in influencing the direct impact

of individual safety actions on performance outcomes. One possible reason is that safety behavior is already an individual-level construct that operates independently of leadership influence once established. Alternatively, it may indicate that leadership interventions are more effective at shaping perceptions (safety climate) rather than directly altering behavioral outcomes. This finding highlights the need for further research to explore the boundary conditions of leadership influence in safety management.

From a theoretical perspective, this study contributes to the development of followership theory by emphasizing the interaction between leadership and employee behavior in achieving organizational safety goals. While leaders play a crucial role in shaping safety climate, employees as followers must actively engage in safe practices to achieve optimal outcomes. The findings suggest that organizational success in safety management depends on a balanced interaction between leadership influence and employee participation. This aligns with Kelley (1992), who argues that followers play a dominant role in organizational success.

Practically, the results provide important implications for the palm oil processing industry in Indonesia, particularly in Indragiri Hulu Regency. Organizations should prioritize strengthening safety climate through consistent leadership commitment and effective safety communication. Additionally, leadership development programs focusing on safety-oriented behaviors should be implemented to enhance managerial effectiveness. While promoting safety behavior remains important, it should be supported by robust organizational systems and leadership practices. By integrating these elements, companies can achieve sustainable improvements in safety performance and reduce workplace accidents.

CONCLUSION

This study concludes that safety climate plays a crucial and statistically significant role in enhancing safety performance within the palm oil processing industry in Indragiri Hulu, Riau, Indonesia. A well-established safety climate, reflected in strong organizational commitment, risk awareness, and structured safety practices, contributes positively to improving overall safety outcomes. In contrast, safety behavior does not demonstrate a significant direct effect on safety performance, indicating that individual compliance and participation alone are insufficient to produce meaningful improvements without adequate organizational support. This finding suggests that safety performance is more strongly driven by systemic and contextual factors rather than solely by individual actions. Furthermore, the results confirm that safety leadership behavior serves as a moderating variable that strengthens the relationship between safety climate and safety performance. Leaders who actively promote safety through coaching, attention, and control mechanisms are able to reinforce the effectiveness of safety climate in influencing performance outcomes. However, safety leadership behavior does not moderate the relationship between safety behavior and safety performance, implying that leadership influence is more impactful at the organizational perception level rather than directly shaping individual behavioral outcomes.

These findings are consistent with the perspective of followership theory, which highlights the interdependent roles of leaders and employees in achieving organizational success. Effective leadership fosters a positive safety climate, while employees as followers contribute through their engagement and adherence to safety practices. Nevertheless, without strong leadership support and organizational systems, individual safety behavior may not translate into improved safety performance. Therefore, achieving optimal safety performance requires a strategic alignment between leadership practices and organizational safety climate. In conclusion, this study emphasizes that sustainable safety performance in the palm oil processing industry can be

achieved through the integration of a strong safety climate and effective safety leadership behavior. Organizations are encouraged to strengthen leadership capacity in safety management while simultaneously fostering a supportive safety culture. Such synergy is essential to ensure that safety initiatives are not only implemented but also internalized across all organizational levels, ultimately leading to improved safety outcomes and reduced workplace risks.

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