

The Impact of Safety Climate and Safety Participation on Employee Safety Performance with Transformational Leadership as a Moderator in the Palm Oil Sector

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ABSTRACT

Occupational safety and health (OHS) is a crucial aspect in the palm oil processing industry, which has a high level of work risk. The high number of workplace accidents indicates that the implementation of safety systems is not optimal. Factors such as *safety climate*, *safety behavior*, and *safety leadership behavior* are believed to influence *safety performance*, but previous research results still show inconsistencies. The study used a quantitative approach with a survey method through a Likert scale questionnaire. The sample was determined using a *purposive sampling technique*. Data analysis was carried out using *Structural Equation Modeling (SEM)* based on *Partial Least Square (PLS)* using SmartPLS software to test validity, reliability, relationships between variables, and moderating effects. The results showed that *safety climate* had a positive and significant effect on *safety performance*, with the dominant indicator *being commitment to safety*. Meanwhile, *safety behavior* (especially *safety participation*) did not have a significant effect on *safety performance*, which was caused by inconsistent and reactive behavior. Furthermore, *transformational leadership* as a moderating variable was unable to strengthen the relationship between the variables and even tended to weaken the influence of *safety climate* on *safety performance*. This indicates that the leadership role is not optimal, especially in terms of role modelling, communication, and the balance between production targets and occupational safety. In conclusion, *safety climate* is the main factor influencing *safety performance improvement*, while *safety behavior* has not made a significant contribution. The role of *transformational leadership* as a moderator is also ineffective, so it is necessary to improve leadership quality and strengthen safety culture comprehensively.

INTRODUCTION

Amidst the dynamics of globalization and free trade, occupational safety and health (K3) is a crucial standard that every country, including Indonesia, must meet (Handoko, 2025) . Every work activity inherently carries a risk of failure that could potentially lead to workplace accidents. No matter how small an accident, it will still have a detrimental impact on both workers and the company. Accident risk prevention and control efforts must be implemented as early as possible to minimize the impact. Human resources are a key factor in determining a company's success. Employees are not merely workers, but key assets that play a direct role in achieving organizational goals. Human resource management must be carried out systematically, planned, and sustainably to optimally contribute to company performance.

The palm oil processing industry is a strategic sector that is highly dependent on workforce performance (Purba & Isa, 2024) . Indonesia, as the world's largest producer of Crude Palm Oil (CPO), with Riau Province as one of its main production centers, demonstrates the sector's importance to the national economy. However, the characteristics of work in this industry carry a high level of risk, ranging from the use of heavy equipment, exposure to extreme temperatures, and the potential for other workplace accidents. Data shows that the number of workplace accidents in Indonesia has continued to increase in recent years. A similar condition also occurs in Riau Province, where the number of workplace accidents and casualties tends to fluctuate but shows a significant upward trend, particularly in the industrial sector. This indicates that the implementation of the Occupational Safety and Health Management System (SMK3) has not been optimal. In practice, occupational safety is still often considered a cost burden rather than a long-term investment for company sustainability.

Specifically in the palm oil processing industry, various types of workplace accidents still frequently occur, such as being hit, crushed, slipping, and falling from heights. In fact, some accidents are considered a common occurrence in operational activities. This situation is exacerbated by low worker awareness regarding the use of personal protective equipment (PPE), a lack of safety education, and weak management oversight. Safety performance is a crucial indicator in assessing a company's success in managing occupational risks (Caldarescu et al., 2021) . Safety performance not only reflects the accident rate but also illustrates the extent to which a company is able to create a safe and productive work environment. High safety performance will have a direct impact on increased productivity and company sustainability.

Various studies have shown that safety performance is influenced by several key factors, including safety climate, safety behavior, and safety leadership behavior (Omidi et al., 2023) . Safety climate relates to workers' perceptions of workplace safety policies and practices, while safety behavior reflects workers' concrete actions in maintaining safety. Safety leadership behavior, on the other hand, describes the role of leaders in shaping a safety culture through direction, supervision, and role modeling.

Based on these empirical phenomena and research gaps, it is important to examine more deeply how safety climate, safety behavior, and safety leadership behavior influence safety performance. Furthermore, this study also attempts to position safety leadership behavior as a moderating variable, which is expected to strengthen or weaken the relationship between these variables. This study is expected to provide both theoretical and practical contributions to improving occupational safety performance, particularly in the palm oil processing industry in Indragiri Hulu Regency, Riau Province.

METHOD

This study uses a quantitative approach with the aim of analyzing the influence of safety climate and safety participation on employee safety performance with transformational leadership as a moderator variable in the palm oil industry sector. The study population was employees working in palm oil processing companies, with the sampling technique using purposive sampling or saturated sampling methods according to research needs. Data were collected through questionnaires using a Likert scale that measures each variable based on indicators that have been tested in previous studies. The data analysis technique used is Structural Equation Modeling (SEM) based on Partial Least Square (PLS) with the help of SmartPLS software to test the validity, reliability, and relationships between variables, including testing the moderating effect of transformational leadership in strengthening or weakening the influence of safety climate and safety participation on safety performance.

DISCUSSION

Safety performance (SP)

The results of the descriptive statistical analysis of the safety performance variable indicate that there are four main indicators used: safety inspection, accident investigation, safety training, and safety motivation. The average score obtained was 3.66, indicating that safety performance in the palm oil processing industry in Indragiri Hulu Regency is included in the high category. This means that the work unit leaders assess that the implementation of occupational safety is quite good and has the potential to continue to be improved towards a zero accident condition. Of the four indicators, safety inspection received the highest score. This is particularly evident in the statement that leaders actively explain work practice audits to employees so that work can be carried out safely. Conversely, the indicator with the lowest score is safety motivation, specifically related to providing incentives to employees who have worked safely.

In general, safety performance reflects leadership efforts to ensure a safe work environment. High safety inspection scores indicate that safety monitoring and inspection activities are considered the most important aspects in maintaining workplace safety (Makomulamin et al., 2025) . Leadership is expected to not only conduct supervision but also explain work risks, work pressure, and workload to employees so they better understand potential hazards. In the palm oil processing industry, occupational risks are quite high, such as falls, slips, being crushed, and exposure to extreme temperatures or

electricity. Therefore, the role of leadership in supervising, providing direction, and involving employees in safety efforts is crucial. If these activities are carried out consistently, the risk of accidents can be reduced and safety performance will improve.

The results of the SmartPLS test also showed that all safety performance indicators were valid. The indicator that most strongly reflected this variable was accident investigation, with the highest outer loading value. This indicates that the accident investigation process plays a crucial role in improving workplace safety, as it can help companies understand the causes of accidents and prevent similar incidents in the future. On the other hand, the low safety motivation score indicates that motivational aspects are still under-appreciated. Leaders tend to rarely give awards or praise to employees who work safely. Based on interviews, this occurs because the company is more focused on achieving production targets, while safety is considered an individual worker's responsibility.

In fact, providing incentives and rewards has been proven to increase employee engagement and performance. Therefore, companies should start considering this motivational aspect as part of their occupational safety improvement strategy. Safety performance is a crucial indicator of a company's performance. The lower the accident rate, the better the company's occupational safety performance. This also aligns with regulations that emphasize the importance of worker protection to create a safe, productive, and prosperous work environment (Juliani et al., 2025).

Safety Climate (SC) Variable

The results of descriptive statistical analysis on the safety climate variable indicate that there are three main indicators: commitment to safety, perceived risk, and emergency response. The average score obtained was 3.78, indicating that work unit leaders rated the safety climate in the palm oil processing industry in Indragiri Hulu Regency as high. This condition indicates that the safety climate is quite good and has the potential to support improved safety performance. Of the three indicators, commitment to safety received the highest score. This is evident from the leaders' perception that the company has supported occupational safety, achieved high safety standards, and actively promoted the importance of safety in every work area (Hu et al., 2020). Conversely, the indicator with the lowest score was emergency response, primarily related to the lack of explanation from leaders regarding actions to be taken in the event of a sudden accident.

Safety climate describes how leaders create and demonstrate safe conditions in the workplace. This climate then influences safety behavior and safety outcomes within the company. A high score on commitment to safety indicates that leadership commitment to safety is considered the most important factor in building a positive safety climate. However, several issues still require attention. Leaders need to be more proactive in providing employees with an understanding of safety procedures, including the steps to take in an emergency. A lack of understanding in emergency situations can increase the risk of greater accidents.

The results of the SmartPLS test also showed that all safety climate indicators were valid in forming the variable. The strongest indicator was commitment to safety, indicating that commitment to safety is a key factor in reflecting the safety climate in a company. The discussion revealed that the implementation of this commitment is not yet fully optimal. Some companies rarely conduct safety training, do not provide adequate personal protective equipment (PPE), and are inconsistent in following up on accident reports. Furthermore, leadership involvement in safety programs is still limited, and safety is often seen as a mere slogan without strong implementation.

Commitment to safety can be considered a key factor in building a positive safety climate. This commitment is not merely a statement but must be realized through concrete actions, such as providing safety facilities, training, and the active involvement of all organizational elements. The success of occupational safety implementation depends heavily on the commitment of all parties, from company leaders to workers. Without a strong and consistent commitment, efforts to build a positive safety climate will be difficult to achieve, and the risk of workplace accidents will remain high.

Safety Behavior (SB) Variable

The results of the descriptive statistical analysis show that the safety behavior variable has two indicators, namely safety compliance and safety participation, with an average value of 3.79, which is included in the high category. This indicates that safety behavior in the palm oil processing industry in Indragiri Hulu Regency is considered good and has the potential to improve safety performance. The indicator with the highest value is safety compliance, which reflects the compliance of work unit leaders with safety regulations, such as following work procedures and using personal protective equipment (PPE). Meanwhile, the lowest indicator is safety participation, which relates to the active involvement of employees in safety efforts, such as reminding each other and participating in accident prevention.

Although compliance was assessed as high, discussions revealed weaknesses, such as low consistency in implementing SOPs, insufficient use of PPE, and minimal reporting of potential hazards. Therefore, leadership must actively participate in improving supervision, education, and providing incentives to optimize safety behavior. Safety compliance is a key factor in safety behavior and plays a crucial role as a predictor of improved workplace safety performance.

Safety leadership behavior (SL) variables

The results of descriptive statistical analysis show that the safety leadership behavior variable has three indicators, namely safety coaching, safety controlling, and (implicit) other safety leadership aspects, with an average value of 3.72 which is included in the high category. This indicates that safety leadership behavior in the palm oil processing industry in Indragiri Hulu Regency is considered good and supports the improvement of safety performance. The indicator with the highest value is safety coaching, which reflects the active role of leaders in providing direction, training, coordination, and supervision related to occupational safety. Meanwhile, the indicator with the lowest value is safety

controlling, especially in terms of the leadership's ability to control and handle workplace accident problems and the use of technology in safety supervision.

The model test results showed that all indicators were valid, with safety coaching being the most dominant indicator. This confirms that the role of leaders as mentors and role models is crucial in developing safety behaviors in the workplace. (Larsman et al., 2024) . Safety leadership behavior plays a crucial role in creating a safety culture through leadership commitment, effective communication, and providing concrete examples. However, improvements in safety control and evaluation are needed to optimize occupational safety performance.

Safety climate has a significant and positive influence on safety performance

Hypothesis testing results indicate that safety climate has a positive and significant effect on safety performance in the palm oil processing industry in Indragiri Hulu Regency, Riau. This means that the better the safety climate perceived by work unit leaders, the better the company's safety performance will be. Safety climate itself reflects the leadership's perception of the importance of occupational safety, including the policies, procedures, and practices implemented within the company. A positive safety climate is formed from the interaction of organizational and individual factors and is a crucial component in driving safety performance.

Research findings indicate that commitment to safety is the most dominant factor in safety climate. This means that leadership commitment to supporting, prioritizing, and promoting workplace safety is key to improving safety performance. The stronger this commitment, the lower the likelihood of workplace accidents. Worker perceptions of safety also influence accident rates. Workers who perceive a safe work environment tend to experience fewer accidents than those who feel unsafe (Ajayi et al., 2021) .

However, the existing safety climate is still suboptimal. Several aspects, such as training, communication, resource support, and incentives, still need improvement. Companies are advised to strengthen their safety commitment through leadership involvement, improved communication, and rewards for employees who behave safely. Safety climate is a crucial factor in creating a safe work environment and a key predictor of improved safety performance.

Safety behavior has no significant positive effect on safety performance.

Hypothesis testing results indicate that safety behavior does not significantly impact safety performance in the palm oil processing industry in Indragiri Hulu Regency, Riau. This means that although safety behavior tends to be positive, it has not been able to provide a tangible impact on improving safety performance. Safety behavior encompasses two main aspects: safety compliance (compliance with regulations and use of PPE) and safety participation (active participation in safety activities). The study results showed that safety compliance was the highest indicator, indicating that work unit leaders were quite compliant with safety regulations. However, the safety participation indicator was below average, thus still categorized as risky behavior (Omid et al., 2023) .

The insignificant influence of safety behavior is thought to be due to several factors. One is that safety behavior is not consistently implemented and tends to

occur only when there is supervision. Furthermore, workers feel accustomed to the work and the risks involved, reducing their vigilance. Safety behavior is also often reactive, meaning it is only implemented after an accident occurs, rather than as a preventative measure. Safety compliance remains an important indicator because it is directly related to adherence to safety procedures. However, its effectiveness can be influenced by other factors such as workload, work pressure, and resource constraints.

Safety leadership behavior moderates the influence of safety climate on safety performance with a negative value.

The test results show that safety leadership behavior as a moderating variable actually weakens the influence of safety climate on safety performance, with a negative coefficient (-0.133). This means that the presence of safety leadership is unable to strengthen the relationship between safety climate and safety performance, and even tends to decrease it. Conceptually, safety leadership behavior reflects the role of leaders as role models in directing, guiding, and influencing subordinates to achieve safety goals. However, in this study, although indicators such as safety coaching, safety caring, and safety controlling were deemed valid, their role was not effective when used as moderating variables.

This situation is thought to be influenced by several factors, such as high work pressure and production targets, which lead to fatigue and reduced attention to safety. Furthermore, leadership's role as role models has not been optimal—more limited to directives than actual practice in the field. As a result, workers tend to ignore safety procedures, including the use of PPE (Wattenbarger, 2024) .

On the other hand, safety climate has been shown to have a direct positive effect on safety performance. However, when combined with safety leadership behavior, this effect weakens. This can also be influenced by factors such as education, experience, ineffective communication, and a work culture that emphasizes target achievement over safety. These findings indicate that safety leadership behavior has not been effective as a reinforcement, and has not even been able to support improved safety performance. Improvements in leadership practices are needed, particularly in terms of role modeling, communication, and the balance between work targets and safety.

Safety leadership behavior does not moderate the influence of safety behavior on safety performance.

The results of the hypothesis testing indicate that safety leadership behavior is unable to moderate the relationship between safety behavior and safety performance in the palm oil processing industry in Indragiri Hulu Regency, Riau. This means that the presence of safety leadership does not strengthen the influence of safety behavior on safety performance. Although the safety coaching indicator is the most dominant indicator in representing safety leadership behavior, its role has not been effective in increasing the impact of safety behavior. Conceptually, safety coaching should assist work unit leaders through guidance, feedback, and support to better understand risks and improve safety behavior. However, in practice, this function has not been functioning optimally.

This situation indicates that the role of leadership as a role model has not been fully realized. Leadership, which is expected to set an example, build a safety culture, and encourage active worker participation, has not been able to significantly influence safety behavior. Consequently, even though safety behavior exists, its influence on safety performance is not reinforced by leadership. This confirms that safety leadership behavior is not yet effective as a moderating variable, so improvements in leadership quality are needed, particularly in terms of role modeling, coaching, and direct involvement in occupational safety practices (Larsman et al., 2024) .

Conclusion

Based on the research results, it can be concluded that safety climate has a positive and significant influence on safety performance, making it a crucial factor in improving occupational safety performance. Conversely, safety behavior did not show a significant influence on safety performance, although descriptively it was in the high category. This indicates that safety behavior has not been implemented consistently and still tends to be reactive, rather than preventive. Furthermore, the dominant indicators in each variable, such as commitment to safety and safety compliance, demonstrate the importance of commitment and compliance with safety regulations in supporting safety performance.

On the other hand, safety leadership behavior has not been able to play an effective role, either as a moderating variable between safety climate and safety performance (even weakening the relationship), or between safety behavior and safety performance (having no effect). This indicates that the role of safety leadership, particularly as a role model, is not functioning optimally. Factors such as work target pressure, lack of role models, and ineffective communication are the main causes of the weak role of leadership in supporting a safety culture.

Suggestion

Companies are advised to strengthen the safety climate by increasing management commitment, providing regular safety training, and improving communication and employee involvement in safety programs. Furthermore, a reward or incentive system is needed for employees who behave safely to increase motivation and participation in safety. The role of safety leadership behavior needs to be enhanced by strengthening leadership as role models, improving the quality of safety coaching, and balancing production target achievement with safety. Companies also need to ensure that safety behavior is not merely a formality but becomes a culture that is consistently implemented to prevent workplace accidents on an ongoing basis.

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