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Quantitative Article

The Mediating Role of Workplace Safety Climate on Safety Leadership and Safety Knowledge in Indonesian Petrochemical Employees

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Abstract

Background/Problem: Effective safety leadership encompasses the capacity of authoritative figures to proactively steer and shape an organization through the adoption of safe practices and principles. Recognizing the pivotal role of leadership behavior in driving employee performance, particularly in facilitating collective bargaining, underscores its importance in organizational studies.
Objective/Purpose: This study aimed to examine the mediation effect of workplace safety climate in the relationship between effective safety leadership and safety knowledge on performance within Indonesian petrochemical sector.
Design and Methodology: Using a quantitative method, data was collected from 198 employees in an Indonesian petrochemical enterprise. Structural equation modeling with partial least squares method was employed for analysis.
Results: The findings reveal that effective safety leadership (β = .48; *p* = .000) and workplace safety climate (β = .47; *p* = .000) significantly influence performance. A workplace safety climate mediates both the relationship between effective safety leadership (β = .13; *p* = .02) and safety knowledge (β = .33; *p* = .02) on performance. This workplace safety climate atmosphere emphasizes adherence to strict safety regulations for consistency.
Conclusion and Implications: The study highlights the need for leaders to reevaluate training methodologies, focusing on enhancing safety knowledge and practical implementation. Strengthening a secure working environment is also emphasized for the well-being and protection of employees. This research contributes to the leadership climate literature by providing additional evidence that effective safety leadership and workplace safety climate can improve employee safety performance. Thus, top management can consider their leadership role during the process of achieving better employee safety performance.

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Effective safety leadership is the ability of authoritative individuals to protectively guide and influence an organization through safe practices and principles. This effective safety leadership type commonly requires two essential elements, namely caring and controlling behaviors (Cooper, 2015). Several studies, including that of Cooper (2015) and Wu et al. (2011) confirmed the indispensability of these two elements in achieving successful safety performance. Moreover, effective safety leadership demonstrate authentic concern for individuals by engaging all in safety measures, expressing gratitude, entrusting responsibilities, attentively considering followers' input, and utilizing pertinent information (Cooper, 2015). Additionally, they oversee operations and outcomes through defining a precise course of

action, specifying expectations, accountabilities, and duties, and establishing and sustaining enhancement objectives (Cooper, 2015; Cooper & Phillips, 2004). Performance is achieved through a leader's adept balance of caring and controlling aspects (Wu et al., 2008). Effective safety leadership is recognized for its positive impact on a company's bottom-line performance (Veltri et al., 2007), it has a positive impact on employee safety behavior and attitudes, helping to reduce injury rates thereby improving operational and safety excellence go hand-in-hand (Cooper, 2001). Companies that are good at managing safety also manage operations well (Fernández-Muñiz et al., 2009). In a study by Wu et al. (2011), safety leadership primarily shaped employee behavior by providing essential resources to collectively achieve organization goals, including the complete elimination of workplace incidents. This supportive process considered various aspects, including the production of personal protective equipment, safety-oriented attention, and analogousmeasures, as detailed in several previous reports (Cooper, 2015; Wu et al., 2011). From this context, leadership support forms served as investments, supporting employees to encourage a symbiotic interdependence strengthening their commitment to working safely. The report analyzing effective safety leadership also introduced a novel perspective, demonstrating the significant authoritative roles in safeguarding the enduring success and adaptability of organizations (Zhao et al., 2021).

The notion of safety performance emphasizes the measurement of protective outcomes at an organization level through various metrics, accompanied by the assessment of individual safety-oriented behaviors. This focuses on the active anticipation and reflection of potential accidents and relevant consequences (Arzahan et al., 2022). Organizations characterized by elevated risk factors also exhibit a heightened emphasis on occupational safety and health, to actively avoid accidents and protect the well-being of the workforce. Moreover, the enhancement of responsible safety behavior is significantly prioritized, particularly where a positive perception is prevalent due to safety-oriented environment (Wu et al., 2011). This shows that the capacity of the employees to identify important environmental factors and implement appropriate measures to address potential risks is considered a responsible protective behavior. According to Mirza and Isha (2017), workplace safety climate reflects perceptions and attitudes towards adequate workplace protection in order to work optimally. These characteristics were obtained from observable behaviors and reflected a collective perspective on organization security. He et al. (2019) also explain that the workplace safety climate emphasizes employees' perceptions of their responsibility in promoting protection within the organization. This climate played a significant role for companies because it directly influenced the attitudes and behaviors of the workforce regarding the prioritization of workplace safety.

A workplace safety climate is subsequently a significant concept portrayed as the specific initial priority for front-line employees in petrochemical organizations, due to the easy occurrence of accidents and incidents to employees (Jafari et al., 2017; Wu et al., 2011). When employees lack awareness of work safety, a significant increase is often observed in the potential for safety-oriented issues and work-related accidents, leading to the loss of assets, property, or lives (Ashraf et al., 2023). Beyond a mere characteristic, it represents a dynamic process of interaction, hat is shaped over time by the profound social cognitive and perceptual processes of group members. These processes collectively establish a pattern of leader-follower interactions (Wu et al., 2021). This was in line with the description of Jafari et al. (2017), where safety knowledge prioritizes commitment and action that can justify that safety in the workplace is something important for every employee to consider. In this context, employees should possess a thorough understanding of the relevant knowledge integrated into daily organization activities, leading to changes in both their comprehension and behavior. The acknowledgment that safety performance was influenced by organization and social factors also encouraged a comprehensive exploration of the safety knowledge and climate domain (Clarke, 2006). This study was conducted at a leading petrochemical company in Indonesia, known for its high-risk operations involving hazardous chemicals, complex manufacturing processes, and heavy machinery. Strong safety leadership is essential in such an environment. The study aims to provide direct evidence of the impact of effective safety leadership and knowledge on performance, with workplace

safety climate as a mediating factor. Focusing on Indonesia, a developing nation, the study offers insights into how safety leadership affects employees and organizational outcomes.

Literature Review

The literature review delineates pertinent theories, concepts, and prior research supporting the relationships between effective safety leadership, safety knowledge on safety performance mediated by workplace safety climate and development of study hypotheses.

Social Cognitive Theory (SCT)

The social cognitive theory originated from Bandura (1986) learning theory and subsequently gained significant prominence as a research framework within the domains of psychology, management, and leadership (Wu et al., 2021). Social cognitive theory posits that human behavior is significantly influenced by self-regulation through three key mechanisms: affective self-reaction, self-monitoring, and judgment against personal standards and environmental conditions. Self-efficacy plays a crucial role in shaping thought, emotion, motivation, and behavior (Bandura, 1991). Bandura (1986) further suggests that behavior depends on one's understanding of social environment, with group cognition influencing individual and organizational behaviors. Leadership development relies on the continues interaction and mutual influence of leaders and followers (Kelley, 2019). Therefore, the application of social cognition to examine the mechanism of leadership emergence in social teams is fruitful, and it offers a significant conceptual framework that elucidates the ongoing and reciprocal relationship among leadership cognition, the leadership environment, and leadership conduct. Jiang et al. (2024) highlight in their findings that safety leadership improves the safety performance of organizations and employees primarily through a cognitive and motivational mechanism that is represented by safety knowledge and effective safety leadership.

Occupational Hazards and Safety Performance

Safety performance is a critical component of overall work performance, as stated by Quansah et al. (2023). Safety performance is the quality of work associated with safety, according to Wu et al. (2008). Several factors were capable of influencing occupational hazards and safety performance, as Yu et al. (2021) identified four keys affecting positive outcomes, including (1) management, (2) supervisory, (3) senior management, and (4) employees. In this context, the indicators contained in the senior management variable included trust, leadership style, and safety attitude. This was accompanied by the indicators of management, which comprised safety priority, engagement, and commitment, interaction, leadership style, humanistic practice, and communication. The predictors of the supervisory variable also contained supervisor engagement and autonomy, as well as supportive and participative supervision. Meanwhile, employee factor consisted of employee engagement, perception, autonomy, motivation, and cohesion (Wu et al., 2011). These variables emphasized safety leadership in the senior, middle, and first-line management levels. Regarding the model developed by Wu et al. (2011), safety leadership and climate were two significant antecedents that significantly affect safety performance. Safety Knowledge also have a significant impact on safety performance (Jiang et al., 2024).

Effective Safety Leadership and Safety Performance

Effective safety leadership is defined as the interchange of leaders and followers to achieve protective business objectives while considering individual and organization factors (Cooper, 2015; Wu, 2005). According to Cooper (2015), leadership style was categorized into two forms, namely safety caring and controlling, which improved protective behavior in subordinates. The positive interactions between supervisors and employees regarding workplace security were related to improved attitudes and knowledge (Shen et al., 2017). Besides, the impact of safety leadership on performance was also explored. For example, Wu et al. (2011) analyzed the effects of protective controlling and caring on performance of four Taiwanese colleges, showing that relevant leadership predicted appropriate efficiency. This was in line with Sahinidis and Bouris (2008), where path analysis and instrumentation were used to determine the impact of caring

and controlling on performance within the manufacturing sector in Malaysia. Cooper (2015) also proved that effective leaders expressed actual care by engaging everyone in safety, expressing appreciation, building trust, actively listening, and acting on information. This led to the control of activities and outcomes through clear direction, defined expectations, accountabilities, responsibilities, and the maintenance of improvement targets. Therefore, optimal performance is achieved when a leader effectively balances the care and control aspects, whose great abundance is capable of leading to underperformance. These descriptions are responsible for the formulation of the following statement:

Hypothesis 1: Effective safety leadership has a positive effect on safety performance.

Effective Safety Leadership and Workplace Safety Climate

Based on Cooper (2015), the most effective leaders were frequently caring and controlling due to effectively implementing communication to provide necessary resources and overcome organization challenges toward goal achievement. Wu et al. (2011) also defined safety caring as the level to which a CEO treated employees with care, compassion, and respect, ensuring a harmonious work environment and addressing relevant needs and concerns. This concept positively impacted safety leadership on safety performance mediated by workplace safety climate in the Taiwanese petrochemical industry (Wu et al., 2011). Sahinidis and Bouris (2008) showed that safety-oriented authority dimensions significantly influenced caring, controlling, and general workplace security in the manufacturing sector within Malaysia, as measured by *safety leadership scale*. Zulkifly et al. (2021) subsequently stated that the organization method affected occupational safety leadership, with its quality impacting organization management. Furthermore, the achievement of occupational performance focused on the culture level within a company and the perception of the protective authority constructing and maintaining tradition. Zhang et al. (2020) also found that the concerns of safety motivation and leadership positively impacted the risk perception of employees in the Chinese chemical industry. These descriptions are responsible for the formulation of the following statement:

Hypothesis 2: Effective safety leadership has a positive effect on workplace safety climate.

Safety Knowledge and Safety Performance

Leadership is an essential factor used to promote workplace safety through influence, skills, and knowledge to motivate a group toward goal achievement (Ashraf et al., 2023; Griffin & Neal, 2000). Based on Cooper (2015), poor attitudes, inadequate understanding and skills, physical incapability, and hazardous environments caused unsafe behavior. This showed that effective leaders identified the importance of building and maintaining positivity and excitement for change to multiply effort (Manning, 2018). Corrective actions were also emphasized to resolve issues and prioritize progress, accompanied by the reflection of commitment to the change effort. In several cases, the leaders subsequently assisted the development of follower's knowledge, skills, and abilities, for better engagement in safety-oriented performance (Cooper, 2015). The acknowledgment that safety performance was influenced by organization and social factors also encouraged a comprehensive exploration of the protection knowledge and climate domain (Clarke & Ward, 2006). Moreover, Grifffin and Neal (2000) perceived safety climate as a holistic concept comprising training, management values, communication, and protective systems.

Safety motivation also had a strong correlation with protective efficiency behaviors, and was influenced by training-based knowledge (Ta et al., 2022). Furthermore, Zhang et al. (2020) showed that safety knowledge directly and positively affected hazard recognition and perception. When passive leadership was exhibited by the leaders, employees were often less likely to actively have participation knowledge in safety-oriented behaviors (Ta et al., 2022). This was empirically in line with the analysis of Malaysian manufacturing SMEs, where appropriate understanding mediated leadership and behavior (Zulkifly et al., 2021). Arzahan et al. (2022) also proved that safety competence, including good understanding, mediated the effect of climate and culture on performance. These descriptions are responsible for the formulation of the following statements,

Hypothesis 3: Safety knowledge has a positive effect on safety performance.

Safety Knowledge and Workplace Safety Climate

The comprehension and aptitude relevant to protection (safety knowledge) are essential for individuals to securely execute tasks and predict safety-oriented behaviors, although subsequent empirical validation is required. For instance, Shin et al. (2015) identified that safety knowledge distinctly influenced a solitary aspect of behavior, namely participation. Manning (2018) also stated that the possession of the protective understanding did not invariably guarantee the manifestation of behavior. Moreover, Yu et al. (2021) emphasized the relevance of safety knowledge concerning protective conduct, showing that understanding did not inherently lead to safety-oriented outcomes. This observation was in line with Manning (2018), although Shen et al. (2017) stated that knowledge partially intervened in the connection between safety climate and behavior. Ashraf et al. (2023) subsequently proposed a dual-stage operational model for enhancing the translation of climate into behavior, prioritizing a favorable association between both factors. These descriptions are responsible for the formulation of the following statement,

Hypothesis 4: Safety knowledge has a positive effect on workplace safety climate.

Workplace Safety Climate and Safety Performance

The perception of employees on the work environment is known as safety climate, regarding workplace protection. This factor significantly influences work-related outcomes, such as injury rates, work performance, organization commitment, and turnover (Hemmelgarn & Glisson, 2018). Positive climate are also associated with a willingness to participate in corporation programs, favorable work attitudes, business dedication, and better job performance. These participatory activities are often carried out with the minimization of negative effects, including stress, turnover intention, and job dissatisfaction. Furthermore, leadership is essential in establishing a positive safety climate in workplace, emphasizing employees understanding of protective job policies, procedures, and behaviors (Ashraf et al., 2023). In Mirza and Isha (2017), climate variable was a perception summary rooted in the physical actions monitored by employees, concerning organization protection. Lee et al. (2019) also argued that leadership was important in establishing a positive job environment. This proved that safety climate prioritized the perception of the significant workplace security, including an understanding of relevant procedures, policies, and behaviors. Griffin and Neal (2000) subsequently stated that the acquisition of knowledge related to safety emphasized significant importance when operating within risky environments. In Sahinidis and Bouris (2008), a resolute dedication to safety harmonized organization safety-oriented protocols, leading to an elevated standard of protective performance. This showed that the successful transference of training was significantly emphasized to achieve an enterprise safety objective. Regarding chemical facilities with a high potential for significant accidents, personnel should have a thorough understanding of operational procedures, associated risks, and mitigation strategies (Shin et al., 2015). The presence of a proficient safety management system also enhanced the depth of employees' safety-oriented knowledge, strengthening security-based motivation and commitment, as well as influencing protective performance improvement (Shin et al., 2015). Based on Shen et al. (2017) and Lee et al. (2019), a positive correlation was established between safety climate and behavior, showing that a favorable work environment enhanced employee performance. These descriptions are responsible for the formulation of the following statement,

Hypothesis 5: Workplace Safety Climate has a positive effect on safety performance.

Mediating Effects of Workplace Safety Climate

According to Fugas et al. (2012), a mediation safety climate model capable of using the social cognition tool was established to describe workplace behaviors. Du and Sun (2012) also analyzed various Chinese coal miners by testing the relationship between the work climate and the indicators of leadership, namely motivation, monitor, and active management. In Clarke and Ward (2006), leadership styles were connected to safety atmosphere, participation, and compliance. The styles focusing on emotional connections and growth between leaders and followers were also beneficial in promoting employee participation. This proved that the authoritative styles reflecting the emotional connection and development of the leader-follower relationship significantly enhanced employees' protective engagement (Clarke & Ward, 2013). A positive safety climate also helped employees manage job demands, increasing endurance

capacity and serving as a resource. Based on Lee et al. (2019), the organizations promoting knowledge sharing and a positive safety atmosphere improved safety behaviors and attitudes of employees by promoting perceptions of support. Griffin and Neal (2000) also stated that clear performance expectations and feedback from good leaders were necessary for employees with protective understanding and motivation to act actively on safety-oriented matters. This proved that protective equipment training was a path for employees to gain knowledge and resources (Liu et al., 2015). Griffin and Neal (2000) subsequently argued safety performance was defined by the understanding and abilities necessary for specific behaviors of individuals and commitment motivation. The concept of workplace safety climate as a mediated variable was first introduced by Wu et al. (2011), who discovered that it acts as a mediator in the connection between safety leadership and safety performance. Furthermore, the correlation between safety knowledge and safety performance may be predicted by the workplace safety climate (Zulkifly et al., 2021). In this context, the mediation effect of workplace safety climate was tested for appropriate performance. These descriptions are responsible for the formulation of the following statements:

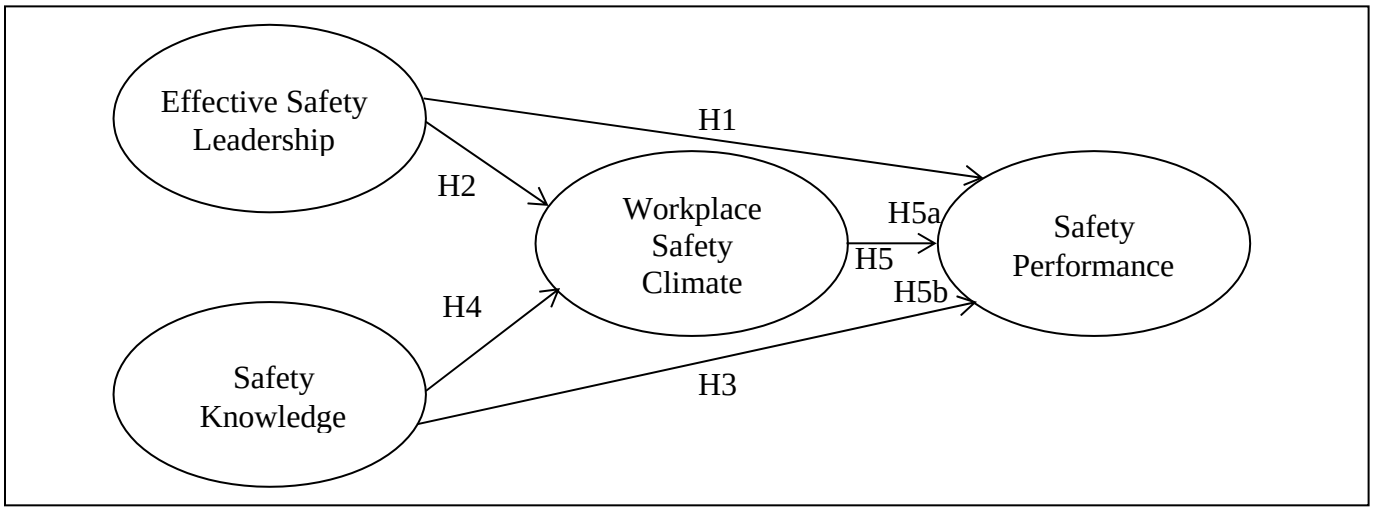
Hypothesis 5a: Workplace safety climate mediates the relationship between effective safety leadership and Performance.

Hypothesis 5b: Workplace safety climate mediates the relationship between safety knowledge and safety performance.

Figure 1 illustrates the conceptual framework of this study.

Figure 1

Proposed Conceptual Framework



Method

Participants

The research has been conducted in Indonesian petrochemical industry, which comprised three operational plants and sustained a cumulative workforce of 391 permanent and contractual staff. The selection of the sample was also conducted through random sampling method, where individuals were arbitrarily selected from the entire population without considering any existing subcategories. In addition, the Slovin formula was applied to determine the appropriate sample size. A self-administered questionnaire survey was implemented from November 1, 2023, to January 14, 2024. a total of 198 participants successfully completed the self-administered questionnaire survey. The regular personnel emphasizing both permanent and contractual staff members were included in the survey participants. These personnel completed the analysis based on their respective departmental affiliations. The majority of the participants were also male (n = 179, 90%) and female (n = 19, 10%), with the production department mostly represented

in the survey (n = 82). This was accompanied by several additional departments, including rotating engineering inspection department (n = 2), fabrication workshop department (n = 9), static engineering inspection department (n = 3), department of occupational safety & health (n = 11), department of environment (n = 5), department of general services (n = 11), maintenance department (n = 7), port management department (n = 10), corporate development department (n = 6), planning and control department (n = 1), department of energy planning & management (n = 8), maintenance strategy planning department (n = 7), warehousing department (n = 8), process & quality control department (n = 7), design andbuild department (n = 8), reliability department (n = 1), research department (n = 8), department of engineering & business (n = 4).

Instruments

An initial exploratory inquiry was carried out to secure authorization for the analysis while performing an evaluation of the prevailing condition within Indonesian petrochemical sector. The accumulation of data also occurred through the dissemination of questionnaires to selected participants, measuring their appraisals concerning the relevant variables. The adapted questionnaire tailored to align closely with the Indonesian context, standard translation procedures (Brislin, 1980) were adhered to in order to guarantee the equivalency of the measures in the English versions of the instrument.

1) Effective safety leadership, which focused on the aspects of caring and controlling dimensions as developed by Wu et al. (2008, 2011). A total of 13 items were included in the questionnaire. Respondents were asked to rate each item on a 5-point scale ranging from 1 (Never) to 5 (Always). An example of effective safety leadership items with caring dimension is “My supervisor shows appreciation when employees meet safety standards”, “My supervisor can resolve conflicts between employees”, the controlling dimension is “My supervisor handles safety fairly”, “My supervisor will promote employees who practice good safety procedures”. The reported Cronbach’s alpha was .96.

2) Safety Knowledge was assessed by Griffin and Neal (2000) with total 4 items were included in the questionnaire in which employees rate their knowledge about safety practices and procedure by utilizing a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly Agree). Sample items are“I am knowledgeable on how to perform my job safely”, “I know how to use safety equipment and standardwork procedures”. The reported Cronbach’s alpha was .93.

3) Workplace safety climate. The 10-item scale developed by Jafari et al. (2017) was used to assess workplace safety climate. Respondents were asked to rate each item on a 5-point scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Sample items are: “I am well informed about my responsibilities related to safety at work”, “I consistently adhere to safety protocols”, “At work, safety takes top priority in my mind”. The reported Cronbach’s alpha was .94.

4) Safety performance. The 12-item scale developed by Wu et al. (2011) was used to assess safety performance. Rated on a 5-point scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Sample items are: is “My supervisor conducts accident investigations in a timely manner”, “The company uses accident investigation information to improve safety”, “The company establishes a self-inspection program”. The reported Cronbach’s alpha was .96.

Procedure

A quantitative method was implemented, and data were obtained through the adoption of a questionnaire-based survey. The assessment of responses was also facilitated through the implementation of a 5-point Likert scale, with data analysis using the partial least square-structural equation modeling (PLS-SEM) method. An official request was issued to conduct workplace survey, and employees were

encouraged to participate. This showed that an initial investigation was carried out to assess the efficacy of the questionnaire, acquiring responses from 40 employees spanning all departments within the three operational plants. Based on the preliminary analysis, minor modifications were introduced to the data instrument for close conformity with Indonesian context. The data collection phase also prioritized the retrieval of 198 responses. For more in-depth analysis, the advanced Smart PLS 3.0 tool was subsequently implemented.

Results

The assessment of the measurement model was conducted using SmartPLS 3.0, to evaluate the reliability and validity of the instrumentation. This assessment was carried out by calculating measures of reliability, as well as convergent and discriminant validities. The process of confirmatory factor analysis was also applied to analyze the interrelationships among the individual items within each construct. In this context, any items exhibiting factor loadings below the threshold of .60 were systematically eliminated from the questionnaire, following the recommendation of Hair et al. (2016).

The Measurement Model

The evaluation of the construct dependability was subsequently performed through the implementation of the indicators emphasizing composite reliability (CR), average variance extracted (AVE), and Cronbach alpha (α). These indicators, ranging between 0 and 1.0, focused on higher values to exhibit enhanced reliability. According to Guzman et al. (2022), a threshold of .70 was recommended for both Cronbach's alpha (α) and CR, with .50 suggested for AVE. Table 1 presents the values of factor loadings, AVE, CR, and Cronbach alpha. In implementing SEM-PLS, the analyzed constructs were reliable even when the Cronbach alpha was below .70. This was in line with the development of measurement model according to Hair et al. (2016), where CR exceeded .70.

Table 1
Validity and Reliability Test among the Study Variables

Construct	Items	Factor Loading	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted
Effective Safety Leadership	14	.71 – .87	.96	.97	.67
Safety Knowledge	4	.90 – .91	.93	.95	.82
Workplace Safety Climate	10	.71 – .88	.94	.96	.66
Safety Performance	12	.76 – .88	.96	.96	.68

Table 1 indicates that all indicators exhibited loading values exceeding .70, enabling the subsequent analytical phase. The analysis results revealed Cronbach's alpha values exceeding .70 for all variables, establishing their reliability. Table 1 illustrates that, for the constructs of effective safety leadership, safety knowledge, workplace safety climate, and safety performance, the AVE root value surpassed the correlation value, meeting the prescribed criteria.

The assessment of discriminant validity assigned considerable importance to mitigate multicollinearity concerns during latent variable analysis (Hair et al., 2016). Discriminant validity is subsequently ascertained through the heterotrait-monotrait ratio (HTMT), considering HTMT's sensitivity in establishing discriminant validity (Guzman et al., 2022). A HTMT value < .90 signifies no substantial issue in discriminant validity. The outcomes are presented in Table 2.

Table 2
The Results of Heterotrait-Monotrait Ratio (HTMT) Test

Variable	(1)	(2)	(3)	(4)
(1) Effective Safety Leadership				
(2) Safety Knowledge	.71			
(3) Workplace Safety Climate	.77	.89		
(4) Safety Performance	.81	.71	.80	

Hypotheses Testing

In analyzing the significance of paths in the conceptual model, t-statistics and *p*-values were examined using the bootstrapping method in SmartPLS. This assessment showed that effective safety leadership (β = .48; *p* = .000) and workplace safety climate (β = .47; *p* = .000) significantly influenced safety performance. However, safety knowledge (β = -.04; *p* = .76) did not impact safety performance indicating that H3 is rejected, as described in Table 3.

Table 3
Hypotheses Testing Results

Path	β	*t*	*p*-value	Results
Effective Safety Leadership → Safety Performance	.48	4.02	.000***	H1 Supported
Effective Safety Leadership → Workplace Safety Climate	.27	4.80	.000***	H2 Supported
Safety Knowledge → Safety Performance	-.04	0.30	.76	H3 Rejected
Safety Knowledge → Workplace Safety Climate	.70	12.49	.000***	H4 Supported
Workplace Safety Climate → Safety Performance	.47	2.65	.000***	H5 Supported
Effective Safety Leadership → Workplace Safety Climate → Safety Performance	.13	2.43	.02*	H5a Supported Mediation
Safety Knowledge → Workplace Safety Climate → Safety Performance	.33	2.45	.02*	H5b Supported Mediation

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Mediation analysis was used to assess the direct and indirect impacts of an independent variable on a dependent factor. This analysis evaluated the significant relationship between independent and dependent variables using a mediating determinant. In this context, a statistically significant indirect effect was identified by a *t*-value > 1.96 and a *p*-value < 0.05, showing the presence of mediation. Table 3 shows that workplace safety climate serves as a mediator for the relationship between effective safety leadership and safety performance (β=.13; $p < .05$), as well as the association of safety knowledge and safety performance mediated by workplace safety climate (β= .33; $p < .05$).

Discussion and Conclusion

The impact of safety leadership dimensions on performance within Indonesian Petrochemical Industries was evaluated, as formulated by Cooper (2015) and, Cooper and Phillips (2004). In this context, the proposed conceptual model included the dimensions of caring and controlling. Regarding the path analysis application, the effective safety leadership emphasizing caring and controlling significantly influenced performance and the prevailing workplace safety climate. Meanwhile, workplace safety climate

directly influenced performance. These results were in line with Wu et al. (2011), Liu et al. (2015), Jafari et al. (2017), and Zulkifly et al. (2021), which confirmed the mediating role of workplace safety climate between safety leadership and performance. Ta et al. (2022) also formulated a theoretical model that focused on the role of safety climate as a precursor to safety performance, prioritizing an indirect effect on occupational injury.

According to He et al. (2019), the importance of combining caring and controlling methods in successful safety leadership was emphasized. Cooper (2015) also stated that effective leadership enabled the participation of various individuals in decision-making and problem-solving processes, to increase their commitment to a specific course of action. Liu et al. (2015) show that safety control was described as the act of maintaining a system within well-defined confines. These analyses showed that employees perceptions of control mechanisms and management commitment to protection, enforcement, and the entire workplace safety climate positively affected the perspectives of safety (Clarke, 2013).

Fugas et al. (2012) also evaluated the direct and indirect ramifications of safety leadership and behavior on performance, implementing employees engaged in coal mining production as participants. This was in line with Goldino and Molina, (2021), where the control beliefs and risk perceptions affected the design of behaviors among drivers in Morocco. Mirza and Isha (2017) also proposed a structured safety training method, corresponding with individual learning styles and personality traits to enhance motivation and content knowledge. This customization potentially heightened the motivation for learning safety-oriented protocols, facilitating quicker and more effective assimilation of training material. The provision of increased control over the training process also enabled employees to adapt their learning strategies more smoothly.

The supervisory safety field was subsequently confronted by persistent issues related to confidentiality breaches, standardization, excessive paperwork, and a perceived tendency to enforce creativity-limiting rules. In this context, the importance of safety caring in behavioral analysis was expressed by understanding and modifying the environmental conditions influencing and motivating safety-related attitudes. Furthermore, effective safety leadership positively affected performance, supporting several relevant studies (Zhang et al., 2020). This investigation encompassed the surveillance of employees' activities, participation in dialogues to comprehend factors that influence behavior, and offering input on less apparent factors (Wu et al., 2011). Additionally, accident rates in safety-critical sectors, such as plant departments, were reduced substantially.

The results subsequently showed that safety knowledge did not significantly influence performance. Meanwhile, a significant effect was only between both variables through the mediation by workplace safety climate. This showed that companies with a high tendency for accidents provided excellent conditions for the prevention of work hazards, specifically in petrochemical organizations (Zhang et al., 2020). From this context, the nonsignificant influence of knowledge on performance was due to the effective safety leadership variable leading and directing employees toward goal achievement by reducing the risk of work accidents. Guzman et al. (2022) also stated that employees were capable of handling the several organization safety threats, understanding the suitable contact to method through the proposed occupational health and safety training provided to plant staff. In contrast, the importance of a positive workplace safety climate was confirmed. This was because employees having a high safety climate perception level commonly reported higher job satisfaction, less turnover intention, and lower work stress. The results also supported a previous study that examined the positive influence of workplace atmosphere on employees and organization outcomes beyond protective matters (Hemmelgarn & Glisson, 2018).

Limitations

Several limitations requiring consideration in subsequent analytical practices were identified. Firstly, safety knowledge was not considered a contextual factor influencing performance. This showed that the

constructs associated with knowledge should be introduced to produce subsequent insights while possessing meaningful outcomes.

Secondly, since the present analysis primarily focused on the intermediary role of workplace safety climate, future studies should advantageously explore protective behavior and commitment, as well as their effects on the analyzed relationships. Furthermore, understanding the complex dimensions of safety leadership could provide valuable insights to leaders for determining and implementing effective supervisory methods. This emphasized the improvement of safety performance and encouraged a more positive climate within the organization. Individual employee-level interviews and focus group discussions should be significantly conducted, to achieve a better understanding of attitudes of employees toward safety and adopt effective leadership strategies. In this case, the outcomes of the future analyses were capable of being affected by employee protective knowledge. Therefore, the accumulation of understanding was important for developing strategic initiatives within organizations, to enhance knowledge levels and supervisory effectiveness at leadership level. From this context, the improvement of the entire safety performance of employees needs to be highly prioritized.

Implications for Behavioral Science

This study supports social cognitive theory (Bandura, 1986, 1991) by examining the interaction between cognitive ability and motivation to lead, influencing leadership emergence. Jiang et al. (2024) found that individuals with high motivation and cognitive ability are more likely to engage in teamwork through effective interpersonal and self-management skills, essential for leadership. Effective leaders possess social resources, share a safety vision, are motivated to influence others, and have relevant cognitive abilities in safety contexts. Effective safety leadership significantly impacts employees' perceptions of the safety climate, with job roles affecting these perceptions more than previously prioritized factors (Dillard & Osam, 2021). Insights highlight the importance of fostering a strong safety culture in high-risk industries like petrochemicals through comprehensive training and strategic leadership selection (Lee et al., 2019). This study contributes to safety performance on petrochemical industries. Effective safety leadership influences employees' well-being and misconduct incidence (Jafari et al., 2017) and is crucial for reducing workplace accidents. Most existing safety performance literature comes from industrialized Western countries (Cooper, 2015; Cooper & Phillips, 2004) and China (Wu et al., 2011), where safety protocols are strictly enforced.

Conclusion

In conclusion, the focal point of the analysis was the assessment of safety performance within Indonesian petrochemical sector. This analysis emphasized the significance of caring and controlling in influencing safety-oriented protocols, specifically within industries characterized by elevated levels of inherent risks. Moreover, the implemented questionnaire helped in identifying the prevailing patterns in supervisory methodologies within leadership levels. The analysis was also more comprehensive, enhancing the understanding of the various cultural backgrounds of the participants. The company was also advised to re-evaluate training methods with the expansion of safety knowledge and its practical application. This situation emphasized the adoption of the training modalities customized to support the distinctive learning styles of employees, regarding their individual personality traits.

Declarations

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