International Journal of Innovation and Industrial Revolution
EISSN: 2637-0972
IJIREV
Volume 5 Issue 13 (June 2023) PP. 01-12
DOI 10.35631/IJIREV.513001

INTERNATIONAL JOURNAL OF INNOVATION AND INDUSTRIAL REVOLUTION (IJIREV)
www.ijirev.com

SAFETY CLIMATE AND SAFETY PERFORMANCE AMONG CONSTRUCTION WORKERS IN LANGKAWI ISLAND, MALAYSIA

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Article Info:

Article history:
Received date: 30.03.2023
Revised date: 16.04.2023
Accepted date: 22.05.2023
Published date: 06.06.2023

To cite this document:

Zulkifly, S. S., & Jun, N. H. M. (2022). Safety Climate and Safety Performance Among Construction Workers in Langkawi Island, Malaysia. *International Journal of Innovation and Industrial Revolution*, *5* (13), 01-12.

DOI: 10.35631/ IJIREV.513001

Abstract:

The construction sector is recognized for its hazardous working conditions, which have led to a multitude of accidents and fatalities. Consequently, ensuring safety within the construction industry remains a crucial concern for all involved parties. This research aimed to investigate the correlation between worker-centric safety climate and safety performance among construction employees in Langkawi. A survey was carried out among construction personnel in Langkawi, Malaysia, utilizing a questionnaire as the primary instrument for data collection. A total of 384 respondents were invited to partake in the study. The questionnaire encompassed queries pertaining to the influence of co-workers, employee attitudes, worker competence, and safety performance. Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) software. The research discovered that the influence of co-workers, employee attitudes, and worker competence had a significant impact on safety performance among construction employees in Langkawi. The empirical evidence corroborated all six hypotheses examined in the research. This study concludes that a worker-centric safety climate is a vital element affecting safety performance within the construction sector. The influence of co-workers, employee attitudes, and worker competence were identified as significant determinants of safety performance among construction personnel in Langkawi. The study offers valuable insights for augmenting worker safety climate and enhancing safety performance in the construction industry.

Keywords:

Safety Climate, Safety Compliance, Safety Participation, Construction Workers, Malaysia

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Introduction

The construction industry is a vital sector in the global economy, contributing significantly to infrastructure development and employment opportunities. However, this industry is also characterized by its hazardous working conditions, which pose a constant threat to the safety and well-being of workers. Accidents and fatalities in the construction sector are alarmingly high compared to other industries (Hämäläinen, Takala, and Boon Kiat 2017). In Malaysia, construction industry contribute to the highest numbers of fatality accidents since decades (Zaini et al. 2022). As a result, ensuring safety performance in the construction industry has become a critical concern for all stakeholders, including policymakers, employers, and workers. Henceforth, in recent years, researchers and practitioners have increasingly focused on understanding the factors that contribute to safety performance in the construction industry. Previous studies have identified two types of indicators to measure safety performance in organizations: lagging and leading indicators. Lagging indicators are retrospective measures, often focusing on the outcomes of safety incidents, such as injury rates, accident frequencies, and fatalities (Lu and Yang 2010; Noor Arzahan, Ismail, and Yasin 2022; Zulkifly et al. 2018). The measure provide insights into an organization's historical safety performance but have limited predictive value for future safety performance. In contrast, leading indicators are proactive measures that assess ongoing safety efforts and processes, such as safety training, employee engagement, safety inspections, and hazard identification (Khan and Kaliannan 2019; Noor Arzahan et al. 2022; Zulkifly, Subramaniam, and Hasan 2017). These indicators are valuable in identifying potential safety risks and preventing accidents before they occur. By combining both lagging and leading indicators, organizations can better understand their safety performance, identify areas for improvement, and implement targeted interventions to enhance overall safety within the workplace (Sawhney and Cigularov 2019).

Scholars advocated that an improved safety performance would reduce occupational accidents (Hasan et al. 2021; Shang, Yang, and Lu 2011; Vinodkumar and Bhasi 2010). Therefore, factors predicting safety performance have been extensively studied by previous researchers. Among all factors, the concept of safety climate has gained considerable attention (Hu, Jimmieson, and White 2022; Lu and Tsai 2010; Neal, Griffin, and Hart 2000; Oswald, Sherratt, and Smith 2013). Safety climate refers to the shared perceptions of workers regarding the importance of safety within their work environment (Zohar 1980). A positive safety climate has been linked to improved safety performance and reduced accident rates (Clarke 2006; Noor Arzahan et al. 2022). Nevertheless, a comprehensive understanding of the specific components of safety climate and their impact on safety performance remains limited.

Based on the literature, previous studies have emphasized the critical role of safety climate factors in shaping safety behaviours, fostering a positive safety culture, and reducing the risk of accidents and injuries. However, despite these valuable insights, there is still a need for further research to better understand the workers related safety climate and its collective impact on safety compliance and safety participation. For example, recent studies have also proposed coworkers safety can influence the safety performance of workers (Ji, Wei, and Chen 2018; Mosly and Makki 2021). On the other hand, personal factors of workers namely safety attitude (Kangavari et al. 2017; Khan and Kaliannan 2019) and safety competence (Bayram 2019; Liang et al. 2019).

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By conducting this study, the aim is to contribute to the existing body of knowledge, offering a more comprehensive understanding of the effect of worker related safety climate factors namely workers safety attitude, workers safety competence, and coworkers safety on safety performance in the construction industry. This research further supports the development of targeted interventions and policies for enhancing workplace safety. Furthermore, Figure 1 illustrates this research model/framework.

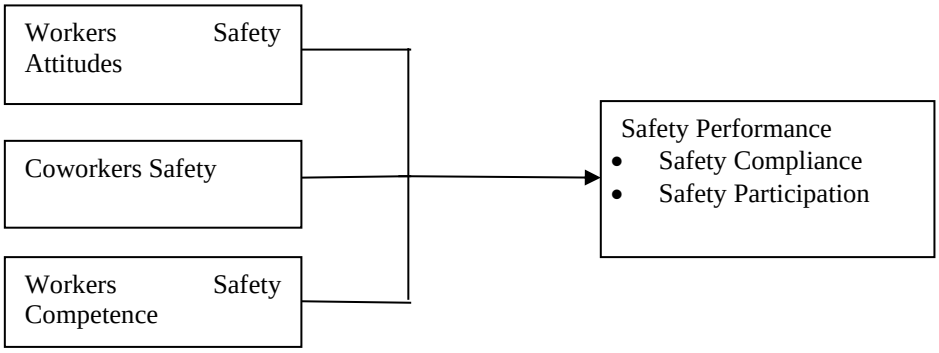

Figure 1 : Research Framework

Research Methods

In this quantitative cross-sectional study, a self-administered survey questionnaire, comprising items adapted from prior research, serves as the primary instrument. The constructs of workers' safety attitude , co-workers' safety and workers' competence were adapted from prior research (Hayes et al. 1998; Lu and Shang 2005; Yousefi et al. 2016). Whilst, safety performance was represented by items measuring safety compliance and safety participation, as per outlined by Vinodkumar and Bhasi (2010). The questionnaire was submitted to experts in the field of Occupational Safety and Health (OSH) to ascertain content and validity, ensuring the rigor and accuracy of the instrument within the academic context. Additionally, the items were meticulously translated into the Malay language using the back-translation (Brislin 1970), and were sent to language expert for face validity. Subsequently, the translated instrument was forwarded to language experts for the evaluation of face validity, ensuring its linguistic accuracy and appropriateness within the academic framework. With some minor modifications, the questionnaire was finalized and accepted as the research instrument.

The survey instrument was disseminated to a 384 construction workers in Langkawi Island, Malaysia, utilizing a purposive sampling methodology. Given that the population size of the study was indeterminate, the formula for determining the appropriate sample size, as established by Krecjie and Morgan (1970) was employed. Based on the formula, the sample size =s was calculated.

$$s= X^2p(1-p)/ d^2 \quad (3)$$
$$s= (1.96)^2*0.5*(1-0.5)/(0.05)^2$$
$$s=3.8416*0.25/0.0025$$
$$s=384.16$$

Subsequently, this research implemented partial least squares structural equation modeling (PLS-SEM) for data analysis, adhering to an advanced application of the extant theoretical (Hair, Ringle, and Sarstedt 2011). This approach provides a robust methodology to uncover

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latent relationships within the research context. In the first stage, the PLS-SEM analysis encompass the assessment of measurement model by determining internal consistency reliability, convergent validity, and discriminant validity. These analyses comprise, Composite Reliability (CR), Average Variance Extracted (AVE), the Fornell-Larcker Criterion, Heterotrait-Monotrait (HTMT) Ratio, R^2 Values, and F^2 Values (Henseler, Ringle, and Sarstedt 2014; Ramayah et al. 2018). In the second stage, structural model was evaluated. he structural model assessment will include the examination of lateral collinearity, hypothesis testing, and path coefficient estimation, ensuring a comprehensive and rigorous evaluation of the research framework(Shmueli et al. 2019).

Findings and Discussions

Initially, the outcomes of the measurement model assessment are presented. Table 1 delineates the evaluation of internal consistency and convergent validity, demonstrating that all constructs' Average Variance Extracted (AVE) values surpass the established threshold of 0.50, signifying satisfactory validity and reliability within the research framework (Ramayah et al. 2018).

Table 1: Convergent Validity

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CWS	0.936	0.938	0.951	0.796
SC	0.873	0.878	0.897	0.555
SP	0.987	0.988	0.99	0.952
WSA	0.937	0.944	0.953	0.803
WSC	0.966	0.967	0.974	0.882

CWS = Coworker Safety WSA= Workers' Safety Attitude WSC= Workers Safety Competence
SP= Safety Participation SC= Safety Compliance

For the purpose of this research, discriminant validity was assessed utilizing the Heterotrait-Monotrait (HTMT) value as well. HTMT represents the ratio of 'between-trait correlations,' a method to evaluate the distinctiveness of the constructs under investigation (Hair et al. 2017). Table 2 presents the HTMT results derived from the current study, providing insight into the discriminant validity of the research constructs.

Table 2: Discriminat Validity (HTMT)

	CWS	SC	SP	WSA	WSC
CWS					
SC	0.263				
SP	0.123	0.691			
WSA	0.372	0.719	0.535		
WSC	0.053	0.72	0.759	0.577	

CWS = Coworker Safety WSA= Workers' Safety Attitude WSC= Workers Safety Competence
SP= Safety Participation SC= Safety Compliance

Table 2 enumerates the HTMT outcomes, illustrating the presence of discriminant validity, as the values fall beneath the established threshold of 0.9. Consequently, the discriminant validity ascertained utilizing the HTMT criterion proved to be satisfactory (Franke and Sarstedt 2019; Ramayah et al. 2018).

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EISSN: 2637-0972
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Furthermore, this stage determined R^2 and f^2 values. Both R^2 and f^2 values play essential roles in evaluating the PLS-SEM model's performance and the relative impact of the independent variables on the dependent variables. The R^2 value signifies the proportion of variance in the dependent (endogenous) variable accounted for by the independent (exogenous) variables within the model. Serving as an indicator of the model's explanatory prowess, R^2 values span from 0 to 1(Hair, Howard, and Nitzl 2020). Elevated R^2 values denote an enhanced capacity for the model to elucidate the variance in the dependent variable, implying a superior model fit within the academic context(Ramayah et al. 2018). On the other hand, the f^2 value is an effect size measure used to determine the relative importance of each independent variable in explaining the variance in the dependent variable. Hence, f^2 helps to assess the magnitude of the impact an independent variable has on the dependent variable within the model (Glass and Cohen 2012; Ramayah et al. 2018). Table 3 presents the R^2 values, while Table 4 displays the f^2 values, both of which pertain to the evaluation of the research model's performance and explanatory capacity within the academic framework.

Table 3: R^2 Values

	R Square	R Square Adjusted
SC	0.61	0.60
SP	0.58	0.57

SP= Safety Participation SC= Safety Compliance

The findings in Table 3 reveal that the R^2 values for safety compliance and safety participation are 0.61 and 0.57, respectively. These values indicate that the independent variables in the model explain 61% of the variance in safety compliance and 57% of the variance in safety participation. Consequently, the model demonstrates a substantial explanatory capacity for both safety compliance and safety participation, providing meaningful insights within the research context (Hair et al. 2017).

Table 4: f^2 Values

	CWS	SC	SP	WSA	WSC
CWS		0.01	0.02		
SC					
SP					
WSA		0.32	0.02		
WSC		0.23	0.67		

CWS = Coworker Safety WSA= Workers' Safety Attitude WSC= Workers Safety Competence
SP= Safety Participation SC= Safety Compliance

The f^2 values quantify the magnitude of each independent variable's contribution in elucidating the criterion variables. As illustrated in Table 4, the f^2 value for co-workers' influence on safety compliance is 0.01 and 0.02 for safety participation. Regarding the impact of workers' safety attitude on safety compliance and safety participation, the f^2 values are 0.32 and 0.02, respectively. In contrast, the f^2 values for workers' safety competence concerning safety compliance and safety participation are 0.23 and 0.67, respectively. According to previous scholars, f^2 values of 0.02, 0.15, and 0.35 denote weak, moderate, and substantial effect sizes, correspondingly (Hair et al. 2011; Ramayah et al. 2018).

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In the second stage of the analysis, which focused on evaluating the structural model, the path coefficient outcomes were utilized for hypothesis testing. Additionally, the results of lateral collinearity assessments were presented, ensuring a comprehensive examination of the relationships between variables and the overall validity of the model. Table 5 conveys the outcomes of the path coefficient analysis, providing insights into the relationships among the variables within the structural model. In addition, Figure 2 depicts the research structural model with path-coefficient results.

Table 5: Path Coefficient

	β value	**t value**
CWS -> SC	0.05	1.92*
CWS -> SP	0.10	3.55**
WSA -> SC	0.48	8.72**
WSA -> SP	0.11	3.08**
WSC -> SC	0.38	7.18**
WSC -> SP	0.68	20.08**

*sig @ p<0.10 **sig @ p<0.05

CWS = Coworker Safety WSA= Workers' Safety Attitude WSC= Workers Safety Competence
SP= Safety Participation SC= Safety Compliance

Table 6: Variance Inflation Factor (VIF)

	CWS	SC	SP	WSA	WSC
CWS		1.255	1.255		
SC					
SP					
WSA		1.845	1.845		
WSC		1.635	1.635		

CWS = Coworker Safety WSA= Workers' Safety Attitude WSC= Workers Safety Competence
SP= Safety Participation SC= Safety Compliance

Table 6 lists the VIF values. All the inner values of VIF were below the threshold of 5.0. Therefore, no multicollinearity issue was found in this study and further analysis was carried out (Hair et al. 2015).

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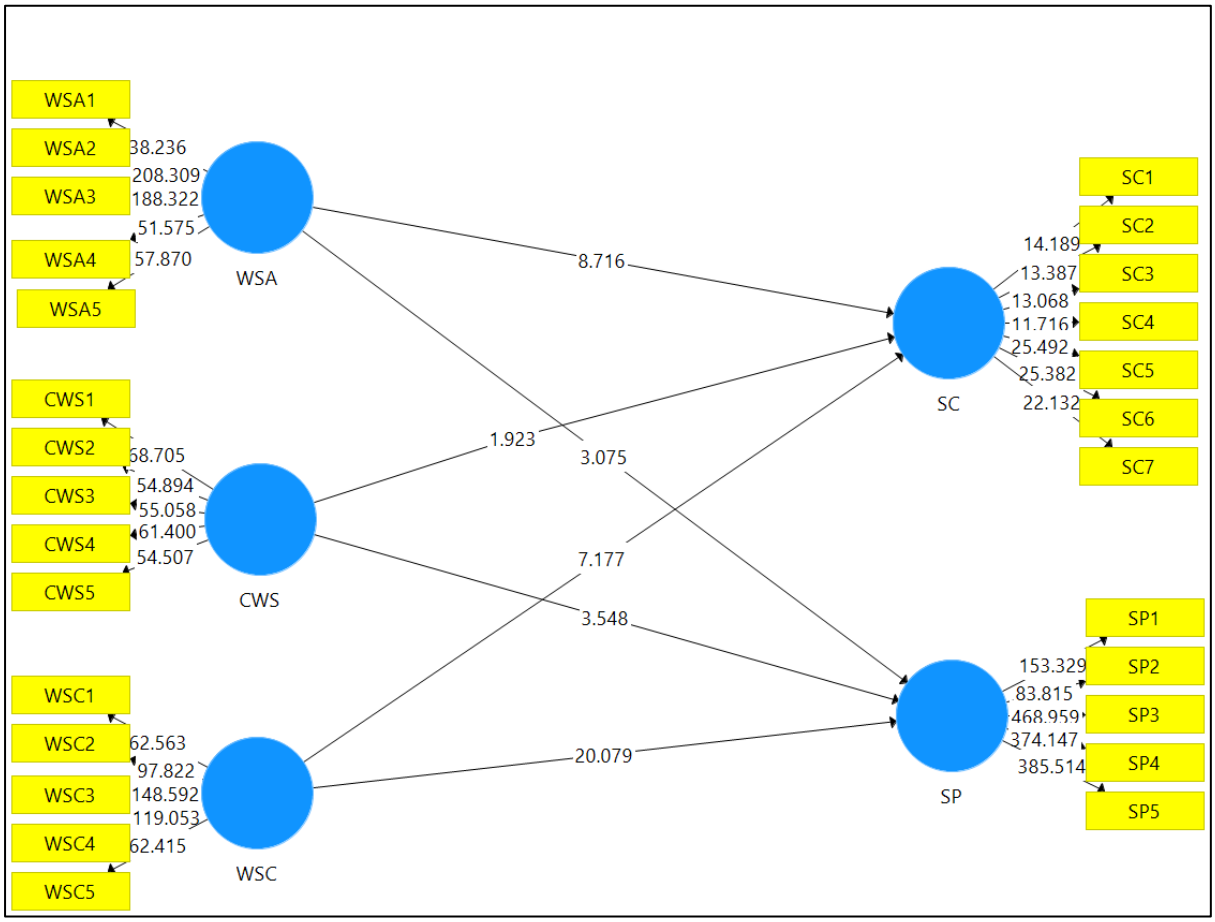

Figure 2: Path Coefficient

The findings delineated in Table 5 reveal a statistically significant association between co-workers' influence and safety compliance, characterized by $\beta = 0.05$, $t = 1.98$, and $p < 0.10$. Moreover, a significant impact of co-workers' influence on safety participation was observed ($\beta = 0.010$, $t = 3.56$, $p < 0.05$). The analysis further unveiled a pronounced effect of workers' safety attitude on both safety compliance ($\beta = 0.48$, $t = 8.72$, $p < 0.05$) and safety participation ($\beta = 0.11$, $t = 3.08$, $p < 0.05$). Additionally, the results indicated a substantial influence of workers' safety competence on safety compliance ($\beta = 0.38$, $t = 7.18$, $p < 0.05$) and also towrds safety participation ($\beta = 0.68$, $t = 20.08$, $p < 0.05$), underscoring the importance of these factors in ensuring safety performance.

As determined by the data analyses, the observed significant association between co-workers' influence and safety compliance underscores the impact of social interactions and peer behavior related to occupational safety on individual compliance with safety regulations. This finding aligns with previous research emphasizing the role of social influence and group dynamics in shaping employee safety behavior (Zohar and Luria 2004). A similar effect was noted for co-worker's safety influence on safety participation, further highlighting the importance of fostering a positive safety culture among employees (Clarke 2006).

The pronounced effect of workers' safety attitude on both safety compliance and safety participation reinforces the critical role of employee attitudes towards safety in promoting their safety performance. Prior studies have also established the significance of individual attitudes towards safety, with positive attitudes correlating with higher compliance and participation

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levels (Griffin and Neal 2000; Khan and Kaliannan 2019). Organizations can benefit from investing in interventions that foster a strong safety attitude, such as training and communication programs (Boateng, Davis, and Pillay 2020).

The strong influence of workers' safety competence on safety compliance and safety participation illustrates the importance of providing employees with the necessary knowledge and skills to perform their tasks safely. This finding reflects previous research which emphasizing the need for adequate training and skill development to enhance workplace safety (Burke et al. 2011; Hinze and Gambatese 2003; Khoo, Surienty, and Selamat 2016). By focusing on the development of safety competence, organisations can improve employees' ability to identify hazards, make informed decisions, and actively participate in safety initiatives.

In conclusion, the results of this study highlight the significant role of co-workers' influence, workers' safety attitude, and worker' safety competence in shaping safety compliance and safety participation in the workplace. workers' safety competence is found to be the most dominant factor in influencing safety performance in terms of safety compliance and safety participation. These findings underscore the importance of considering these factors when designing and implementing safety interventions. By fostering a supportive safety culture, promoting positive safety attitudes, and enhancing safety competence, organizations can improve overall workplace safety and reduce the risk of accidents and injuries.

Contributions of the Study

The present study makes several important contributions to the understanding of workplace safety, particularly in the context of the relationships between co-workers' influence, workers' safety attitude, workers' safety competence, and their effects on safety compliance and safety participation.

Firstly, the study sheds light on the role of co-workers' influence on safety compliance and safety participation, providing empirical evidence that supports the importance of social interactions and peer behavior in promoting a safe work environment. This finding extends the current understanding of the role of social dynamics in shaping employee behavior and safety culture.

Secondly, the study reinforces the crucial role of employees' safety attitudes in fostering safety compliance and safety participation. By providing quantitative evidence of the impact of safety attitude on these outcomes, the study contributes to the existing body of literature on the importance of employee attitudes in shaping workplace safety.

Additionally, the study highlights the influence of workers' safety competence on safety compliance and safety participation, illustrating the importance of providing employees with the necessary knowledge and skills to perform their tasks safely. This finding supports the need for organizations to invest in training and skill development initiatives to enhance workplace safety.

Finally, the study offers valuable insights for organizations looking to improve workplace safety. By demonstrating the significance of co-workers' influence, workers' safety attitude, and workers' safety competence in promoting safety compliance and participation, the findings

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provide a foundation for organizations to develop targeted interventions and policies that foster a supportive safety culture and enhance employee safety performance.

Overall, this study contributes to the existing literature on workplace safety by providing a deeper understanding of the factors that influence safety compliance and safety participation. The findings have important implications for both researchers and practitioners, as they emphasize the need to consider the complex interplay between social dynamics, employee attitudes, and competence when designing and implementing safety initiatives.

Conclusion

In conclusion, this study provides valuable insights into the relationships between co-workers' influence, workers' safety attitude, workers' safety competence, and their effects on safety compliance and safety participation in the workplace. The findings emphasize the importance of considering these factors when designing and implementing safety interventions to improve overall workplace safety and reduce the risk of accidents and injuries.

The study demonstrates several advantages, including the provision of empirical evidence that supports the role of social dynamics, employee attitudes, and competence in shaping workplace safety. By identifying the significant relationships between these factors and safety compliance and participation, the research contributes to the existing literature and offers a foundation for organizations to develop targeted interventions and policies. Furthermore, the study highlights the practical implications of the findings for organizations, emphasizing the need to foster a supportive safety culture, promote positive safety attitudes, and enhance safety competence to improve employee safety performance.

Despite these advantages, the study is subject to certain limitations. For instance, the research is focused on the construction industry in a specific geographical region, which may limit the generalizability of the findings to other industries and contexts. Future research could explore the relationships between co-workers' influence, workers' safety attitude, workers' safety competence, and safety outcomes in different industries and geographical locations to further validate and expand on the present findings.

Potential applications of this research include informing the design of safety training programs, communication initiatives, and organizational policies aimed at enhancing workplace safety. Organizations can leverage the findings to tailor their interventions to address the specific needs and challenges of their employees, considering the influence of co-workers, safety attitudes, and competence in shaping safety compliance and participation.

In light of these findings and limitations, future research directions should aim to extend the scope of the study by examining these relationships in different industries and geographical locations. Additionally, future studies could investigate the potential moderating or mediating factors that may influence the relationships between co-workers' influence, workers' safety attitude, workers' safety competence, and safety outcomes. This could provide a more nuanced understanding of the dynamics at play in workplace safety and offer further insights for the development of effective interventions and strategies.

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EISSN: 2637-0972
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In summary, the study sheds light on the complex interplay between social dynamics, employee attitudes, and competence in promoting workplace safety. By understanding the significant relationships between these factors and safety outcomes, organizations can develop more effective strategies to foster a supportive safety culture and enhance employee safety performance. The findings of this study have important implications for both researchers and practitioners, suggesting potential applications and extensions in the field of workplace safety, and outlining promising directions for future research.

Acknowledgement
The authors would like to extend their sincere gratitude to the anonymous referees of this journal for their invaluable suggestions, which greatly contributed to the improvement of the article's quality. Additionally, the authors express their deep appreciation to the respondents who voluntarily participated in this study. It is important to note that the customary disclaimers apply.

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