



Please cite this article as: Hamdan, H., Mahmood, R., Abdullah Hashim, R., & Rosli, N. S. (2023). Building a safer future: The impact of safety leadership and safety competency in the construction industry. *The Asian Journal of Professional & Business Studies*, 4(2), 107–118. <https://doi.org/10.61688/ajpbs.v4i2.124>

BUILDING A SAFER FUTURE: THE IMPACT OF SAFETY LEADERSHIP AND SAFETY COMPETENCY IN THE CONSTRUCTION INDUSTRY

Hamizi Hamdan^{1*}, Rosli Mahmood¹, Raemah Abdullah Hashim², Nur Shazwani Rosli³

¹Putra Business School, Universiti Putra Malaysia,

²Business School, City University Malaysia

³Sunway University Malaysia

Corresponding author*: hamizih@gmail.com

Received 31 Oct 2023, Revised 20 Nov 2023, Accepted 30 Nov 2023, Published 31 Dec 2023

ABSTRACT

The Malaysian construction industry has experienced a concerning trend, ranking fifth in accidents from 2017 to 2021 and witnessing the highest number of fatal workplace injuries compared to other sectors. This study aimed to investigate the influence of safety leadership and safety competency on safety culture within the construction industry. To conduct this research, data were collected from 385 supervisors, engineers, and project managers employed by Grade G7 contractors registered with the Malaysian Construction Industry Development Board (CIDB) in four Peninsular Malaysia states. A systematic random sampling method was employed, and data analysis was conducted using SmartPLS 4. The study findings underscore the significance of both safety leadership and safety competency in positively impacting safety culture within the construction industry. The practical implications of these findings suggest that contractors should prioritise safety leadership and allocate resources to safety training and development initiatives. By enhancing employees' safety competencies, organisations can contribute to the establishment of a robust safety culture, ultimately addressing the industry's safety challenges. This research sheds light on the crucial factors that can contribute to improving safety outcomes in the Malaysian construction industry.

Keywords: *Safety Competency, Safety Culture, Safety Leadership*

Copyright: © 2023 The Author(s)

Published by Universiti Poly-Tech Malaysia.

This article is published under the Creative Commons Attribution (CC BY 4.0) license: <http://creativecommons.org/licenses/by/4.0/legalcode>

1. INTRODUCTION

The construction industry plays a pivotal role in a nation's economic landscape, as its impact on the gross domestic product (GDP). Nevertheless, the construction industry also is infamous for its harsh, hazardous, and challenging working conditions (Ishak & Azizan, 2018). It is consistently reporting high rates of workplace accidents, including fatalities, permanent disabilities, and non-permanent disabilities (Abas et al., 2020; Okwel et al., 2019). Department of Occupational Safety and Health (DOSH) Malaysia statistics reveal that from 2017 to 2021, construction accidents in Malaysia remained relatively high. Within this period, the construction industry consistently held the unfortunate distinction of having the highest number of fatalities, except for 2020 when it temporarily dropped to second place with fewer than seven fatalities compared to the highest (manufacturing industry). The fatality rate as a percentage of all accidents stood at 46% in 2017, 51% in 2018, 26% in 2019, 32% in 2020 and 30% in 2021 (Department of Occupational Safety and Health, n.d.).

Research has consistently demonstrated that a strong safety culture significantly contributes to improved safety performance (Mohammadi et al., 2018; Nawi et al., 2016). Generally, safety leadership and safety competency could have significant positive effects on safety culture. Safety culture was defined as the perceptions of employees regarding safety conditions and their impact on safety outcomes (Wu et al., 2010). Meanwhile, safety leadership had a substantial impact on safety culture, and in turn, safety culture significantly influenced safety performance (Atikasari et al., 2022). Safety competency holds paramount importance across various industries, directly impacting both individual well-being and overall organizational success (Yang et al., 2022).

In the current research, safety culture, safety leadership, and safety competency questionnaires were administered to employees working for Grade G7 contractors in Malaysia. The primary objective of this study is to investigate the effects of safety leadership and safety competency on the safety culture within Malaysia's construction industry.

2. LITERATURE REVIEW

2.1. Safety Culture

The concept of safety culture within organizations is a multifaceted and evolving one, with various perspectives offered by scholars in the field. Safety culture is a subset of an organization's broader culture, emerging from collaborative interactions among individuals and the development of social ties within the workplace (Wamuziri, 2006). Safety culture should not exist as a separate entity but be an integral part of the overall organizational culture (Haukelid, 2008). Safety culture is often categorized into six key characteristics: management and supervision, safety systems, risk management, work pressure, competence, and adherence to procedures and rules (Cooper & Psychol, 2016).

The establishment of a robust safety culture is vital for reducing workplace incidents and hazards, particularly in high-risk industries like agriculture and construction (Odu et al., 2018). However, recent attention has shifted towards healthcare and patient safety culture, taking precedence over the subdomain of organizational safety culture (Van Nunen et al., 2018).

2.2. Safety Leadership and Safety Culture

Safety leadership is recognized as a critical factor in shaping a robust safety culture and influencing safety performance outcomes (Indrayana et al., 2022). Occupational health and safety leadership plays a pivotal role in safeguarding employee well-being, mitigating workplace risks, and preventing job-related injuries or illnesses (May et al., 2019). While regulatory bodies establish safety regulations, their effectiveness in improving safety standards and performance largely depends on how organizations and their leaders prioritize and implement safety measures (Kim et al., 2021).

Leadership is considered indispensable for cultivating a positive and goal-oriented health and safety culture (Fewster, 2018). It plays a crucial role in instilling safety values at work, ultimately leading to a reduction in workplace accidents (Du & Sun,

2012). Conversely, the absence of effective leadership is identified as a significant contributor to persistently high accident rates in construction projects (Wu et al., 2017). Safety leadership encompasses two vital functions: directing employees to perform tasks safely and fostering positive relationships with them to influence their behavior regarding safety factors (Krause, 2005). These leadership behaviors impact subordinates' motivation, expectations, and, consequently, their safe or unsafe conduct (Flin & Yule, 2004).

In the construction industry, front-line management holds significant influence due to its proximity to the workforce, which enhances managerial effectiveness (Cooper, 2010). Leaders who exhibit effective safety leadership styles foster trust and cooperation among their followers (Luria & Morag, 2012). Supervisors demonstrating strong safety leadership directly influence employees' risk perceptions, safety awareness, adherence to safety procedures, participation in safety measures, and overall safety compliance (Oah et al., 2018). Key leadership behaviors that positively impact safety include continuous planning and coordination, role modeling, work monitoring, and proactive deviation correction (Grill & Nielsen, 2019). Effective safety leadership is characterized by ethical conduct, professionalism, technical expertise, responsibility, teamwork promotion, and a commitment to balancing organizational and employee needs while advancing the common good (May et al., 2019). Research reveals there was a significant positive effect of safety leadership and safety culture on safety performance, however, research does not explore the direct relationship between safety culture and safety leadership, treating them as independent variables (Setiono et al., 2018). Multiple studies yield diverse findings regarding the association between safety leadership and safety culture. For instance, in a study, safety culture is the primary predictor of safety performance within a Portuguese construction firm, with safety leadership having no direct influence (Magalhães et al., 2022). Other studies, reveal a marginal but significant effect of leadership on safety culture (Khasanah et al., 2019), and safety leadership negatively impacts the organization's safety culture (Stiles et al., 2018). Based on these arguments, the following hypothesis is posited:

H1: Safety leadership significantly affects safety culture.

2.3. Safety Competency and Safety Culture

Competency, a multifaceted concept, encompasses various behavioral attributes necessary for individuals to excel in their roles and perform effectively (Woodruffe, 1993). Competency includes knowledge, skills, abilities, and traits linked to superior job performance, such as problem-solving and leadership (Mirabile, 1997). Competency is also defined as the combination of skills, knowledge, and personal attributes contributing to an individual's success in a specific role (Giesecke & McNeil, 1999).

Safety competency is of paramount importance across industries, directly impacting individual well-being and organizational success (Yang et al., 2022). In sectors like construction, employee competence significantly influences safety management evaluations, emphasizing the need for a deep understanding of safety principles and effective safety practices (Wang et al., 2021). Safety participation, job competence, and behavioral compliance are interconnected, with enhanced competence contributing to overall safety performance and adherence to safety protocols (Wang et al., 2021). A lack of safety competency in high-risk industries can lead to catastrophic consequences and numerous injuries (Yang et al., 2022). Organizations must prioritize safety competency by providing training and support to ensure employees' proficiency in implementing safe practices (Mazzuto et al., 2022).

In healthcare, nurses' competence in patient safety is critical for minimizing harm and ensuring patient well-being (Lee et al., 2020). Nurses need knowledge about patient safety concerns, preventive measures, and the ability to respect patients' values and beliefs (Lee et al., 2020). Registered nurses who embrace a robust safety culture are more likely to exhibit competence in patient safety (Cho & Choi, 2018). Nurses' competencies play a pivotal role in mitigating adverse events and supporting a patient safety culture (Han et al., 2020). To uphold safety standards and deliver quality patient care, organizations must prioritize nurses' professional competence (Feliciano et al., 2021). This includes emphasizing teamwork, leadership, and ongoing education (Cho & Choi, 2018).

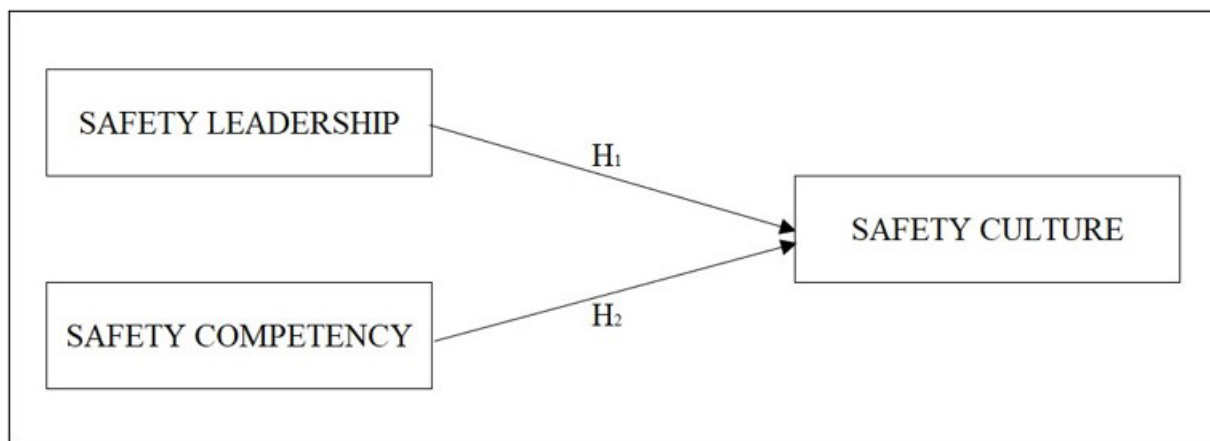
While there is ample research on the relationship between safety competency and safety culture in healthcare, limited information is available for other industries. Most references in this context focus on healthcare settings and patient safety

culture, making it challenging to draw definitive conclusions about this relationship in other sectors. Further research is needed to explore the relationship between safety competency and safety culture in different industries and contexts. Therefore, the following hypothesis was posited:

H2: There is a significant effect of safety competency on safety culture

The research framework establishes a connection between safety leadership, safety competency, and safety culture, as depicted in Figure 1. Through a comprehensive review of existing literature, this study identifies a gap, specifically the absence of a comprehensive study in the Malaysian construction industry context. Consequently, this research serves as a valuable addition to the current body of knowledge and industrial practices. It suggests that safety leadership and safety competency have the potential to exert significant positive influences on safety culture, ultimately contributing to the reduction of accidents and fatalities in the construction industry. In essence, this study addresses a critical research gap and underscores the importance of enhancing safety practices in the Malaysian construction industry.

Figure 1:
Research Framework



3. METHODOLOGY

3.1. Sample and Procedure

This study aimed to make an original contribution to the discipline and adopted a quantitative approach within the positivist paradigm to seek the generalisability of findings. A cross-sectional survey was employed to collect data, and participants were selected using systematic random sampling, a method known for its ability to simplify the drawing of samples and provide accurate estimators (Mostafa & Ahmad, 2018). The study population comprised 6,103 Grade G7 contractors registered with the Malaysian Construction Industry Development Board (CIDB) located in Selangor, Kuala Lumpur, Johor, and Pulau Pinang. The necessary information about these contractors, including their names, addresses, phone numbers, and details, was available on the Malaysian CIDB website. Established sample selection criteria were utilized (Saunders et al., 2016), and data were collected from supervisors, engineers, and project managers, who play key roles at construction project sites. A 5-point Likert scale was employed for data collection.

Data were collected using Google Forms and self-reported survey questionnaires due to their cost-effectiveness and efficiency in rapid data collection. The survey's URL was embedded in emails sent directly to participants, accompanied by regular reminders to enhance survey participation. Email was the primary distribution method for the survey, and respondents were assured that their responses would remain confidential. They were also given the option to contact the researcher

directly through phone, email, or WhatsApp if needed. Participation in the survey was entirely voluntary. A total of 1,110 questionnaires were emailed to contractors, resulting in 385 responses, yielding a response rate of 34.68%, which was considered acceptable, especially given the typically low response rates in survey research. A 30% response rate is generally regarded as acceptable, and in many cases, even exceptional (Sekaran & Bougie, 2016).

3.2. Measures

This study investigates the relationships between safety leadership and safety culture, as well as safety competency and safety culture. The research employs questionnaires consisting of a total of 32 items designed to measure employees' perceptions and feedback on company safety culture (12 items), safety leadership (10 items), and safety competency (10 items). These questionnaire items are adopted, adapted, and validated based on previous studies in the field.

The Safety Culture Scale (SCU) utilized in this study, consisting of twelve items, to assess safety culture (Díaz-Cabrera et al., 2007). The reliability of this scale is demonstrated with a Cronbach's Alpha value of 0.949, which exceeds the recommended level. Respondents provide their feedback on a 5-point Likert scale, where options range from “Strongly Disagree = 1” to “Strongly Agree = 5”. The SCU survey instrument comprises a total of twelve (12) items.

For measuring safety leadership, the Safety Leadership Scale (SLS) is employed, which is a ten-items scale (Wu et al., 2008). The scale's reliability is confirmed with a Cronbach's Alpha of 0.921. Like the SCU, respondents indicate their responses on a 5-point Likert scale.

To assess safety competency, the Safety Competency Scale (SCT) is utilized, consisting of ten items (Salleh, 2010). The reliability of this scale is indicated by a Cronbach's Alpha value of 0.745. Similar to the other scales, respondents rate their responses on a 5-point Likert scale.

4. FINDINGS AND DISCUSSION

4.1. Hypothesis Testing and Results Analysis

To verify the absence of multicollinearity, the dataset was assessed by calculating tolerance values and the Variance Inflation Factor (VIF), as shown in Table 1. According to accepted standards, a tolerance value above 0.10 and a VIF below 10 indicated no significant multicollinearity concerns (Kim, 2019). These thresholds served as guidelines to determine the presence or absence of multicollinearity in the analysis.

SmartPLS4 was utilized for this study. The PLS-SEM comprised two primary stages. The initial phase, known as the measurement model, centered on evaluating the reliability and validity measures. In the subsequent phase of PLS analysis, a structural model was constructed. During this phase, PLS-SEM was employed to investigate the connections among the factors recognized in the measurement model and to conduct hypothesis testing (Marcos et al., 2020).

The assessment of the measurement model included conducting reliability and validity tests. Reliability tests assessed the consistency of the measurement instruments used to measure the concepts. The reliability of individual items was determined by examining their outer loadings, and an item with an outer loading of 0.70 was considered reliable and acceptable (Hair et al., 2014). However, they also recommended retaining items with loadings between 0.40 and 0.70, and deletion was only considered if removing an item led to an increase in the Average Variance Extracted (AVE) and composite reliability (CR). In this study, items with outer loadings above 0.6 were retained. Three items with outer loadings below 0.6 (SCT7, SCT8, and SCT10) were deleted from the initial model. For internal consistency, the composite reliability (CR) index was calculated using Fornell-Larcker (Fornell & Larcker, 1981). The CR value indicated the extent to which the construct indicators reflected the latent variable. A threshold value of 0.7 was commonly used, and indicators exceeding this threshold were considered significant, indicating the consistency of the measurement (Hair et al., 2014) (See Table 2).

Construct validity refers to the extent to which the outcomes derived from a measurement aligned with the underlying concepts that the study aimed to investigate (Sekaran & Bougie, 2016). To evaluate construct validity, two important tests were conducted: convergent validity and discriminant validity. Convergent validity assessed the degree of agreement among multiple items that measured the same concept. In this study, convergent validity was measured using factor loadings, composite reliability (CR), and average variance extracted (AVE) (Table 2). Safety Culture items (SCU1 to SCU12) displayed substantial factor loadings (0.735 to 0.915), AVE of 0.702, and CR of 0.966. Safety Leadership items (SLS1 to SLS10) also exhibited strong factor loadings (0.739 to 0.871), AVE of 0.691, and CR of 0.957. Safety Competency demonstrated moderate to high factor loadings (0.685 to 0.918), AVE of 0.752, and CR of 0.955.

Discriminant validity referred to the degree to which a specific latent construct differed from other latent constructs (Hair et al., 2014). When a latent construct was unique and captured phenomena not represented by other constructs, it indicated the establishment of discriminant validity (Hair et al., 2014). Two methods for assessing discriminant validity were suggested by Hair et al. (2014), one of which was the Fornell-Larcker criterion. According to this criterion, a construct demonstrated discriminant validity when the square root of its average variance extracted (AVE) exceeded its correlation with other constructs within the same model. This suggested that the construct shared more variance with its associated indicators than with other constructs in the model, thus distinguishing it from the others (Hair et al., 2014). In this study, the Fornell-Larcker criterion was employed to assess discriminant validity, and the results are presented in Table 3. Using the Fornell-Larcker criterion, discriminant validity was assessed by calculating the square root of the Average Variance Extracted (AVE) for each construct and then comparing it with the corresponding correlation coefficients (Table 3). The square root of the AVE values for Safety Competency, Safety Culture and Safety Leadership were approximately 0.867, 0.838, and 0.831, respectively. Upon comparing these square root values with their respective correlation coefficients, it became evident that the square root of the AVE for each construct was higher than its correlation with other constructs, confirming the presence of discriminant validity among all the constructs.

The subsequent stage in PLS analysis involved the construction of a structural model, which depicted the relationships among the hypothetical constructs. The evaluation of the structural model incorporated the consideration of R² values, effect size (f²), and the predictive relevance of the model (Hair et al., 2014). To assess the proposed hypotheses of the model, the level and significance of the path coefficients and bootstrapping techniques were employed. These analyses contributed to the examination of the relationships within the structural model and the testing of the proposed hypotheses. The magnitude or extent of the effect of an exogenous latent variable on an endogenous latent variable, which helped assess the model fit, was measured by the effect size (f²) of the path coefficient. The effect size provided indices that described the strength of the relationship between these variables. Additionally, the predictive relevance of the model was demonstrated through Q² coefficients. Q² reflected the quality of the model by assessing how well the observed values aligned with the model and its parameter estimates (Hair et al., 2014).

R² represented the coefficient of determination and indicated the proportion of variance in the dependent variable (Safety Culture) that could be explained by the independent variables (Safety Leadership, and Safety Competency). In this case, the R² value for Safety Culture was 0.555, suggesting that approximately 55.5% of the variance in Safety Culture could be accounted for by the independent variables in the model. Q² was a measure of the model's predictive relevance, representing how well the observed values aligned with the model's predictions. For Safety Culture, the Q² value was 0.544, indicating that the model had strong predictive relevance for this construct. f², on the other hand, represented the effect size and measured the magnitude or strength of the relationship between an exogenous variable (independent variable) and an endogenous variable (dependent variable). In this case, the f² values were provided only for the independent variables. Safety Leadership had an f² value of 0.511, indicating a strong effect on Safety Culture, and Safety Competency had an f² value of 0.118, indicating modest effect on Safety Culture.

Table 4 provided information on the significance testing for the direct relationships between variables. Hypotheses 1 (H1) investigated the relationship between Safety Leadership and Safety Culture. The original sample value was 0.566, with a sample mean of 0.568 and a standard deviation of 0.050. The T statistic was calculated as 11.356, indicating a highly significant relationship. The corresponding P-value was 0.000, which was less than the significance level of 0.05. Therefore, Hypothesis 1 was supported, suggesting a significant relationship between Safety Leadership and Safety Culture.

Hypothesis 2 (H2) examined the relationship between Safety Competency and Safety Culture. The original sample value was 0.269, with a sample mean of 0.271 and a standard deviation of 0.044. The T statistic was calculated as 6.133, indicating a highly significant relationship. The corresponding P-value was 0.000, which was less than the significance level. Therefore, Hypothesis 2 was supported, indicating a significant relationship between Safety Competency and Safety Culture.

Table 1:
Collinearity Statistics of Variables

Variable	Tolerance	VIF
Safety Leadership	0.894	1.119
Safety Competency	0.894	1.119

Dependent Variable: Safety Culture

Table 2:
Test of internal consistency and convergent validity

Construct	Item	Loading	Average Variance Extracted (AVE)	Composite Reliability (CR)
Safety Culture (SCU)	SCU1	0.868	0.702	0.966
	SCU2	0.766		
	SCU3	0.910		
	SCU4	0.829		
	SCU5	0.878		
	SCU6	0.910		
	SCU7	0.892		
	SCU8	0.915		
	SCU9	0.780		
	SCU10	0.797		
	SCU11	0.735		
	SCU12	0.746		
Safety Leadership (SLS)	SLS1	0.802	0.691	0.957
	SLS2	0.834		
	SLS3	0.822		
	SLS4	0.739		
	SLS5	0.871		
	SLS6	0.821		

	SLS7	0.864		
	SLS8	0.861		
	SLS9	0.828		
	SLS10	0.864		
Safety Competency (SCT)	SCT1	0.874	0.752	0.955
	SCT2	0.899		
	SCT3	0.902		
	SCT4	0.918		
	SCT5	0.896		
	SCT6	0.875		
	SCT9	0.685		

Table 3:
Measurement Model Discriminant Validity (Fornell-Larcker)

Construct	SCT	SCU	SLS
Safety Competency (SCT)	0.867		
Safety Culture (SCU)	0.573	0.838	
Safety Leadership (SLS)	0.534	0.709	0.831

Table 4:
Structural Model: Test of Significance for Direct Relationships

Hypotheses	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values	Decision
H ₁	Safety Leadership -> Safety Culture	0.566	0.568	0.050	11.356	0.000	Supported
H ₂	Safety Competency -> Safety Culture	0.269	0.271	0.044	6.133	0.000	Supported

5. DISCUSSION

This study demonstrated the significant positive effect of safety leadership on safety culture in the Malaysian construction industry. Effective safety leadership behaviours, such as promoting safe practices, facilitating clear communication, setting an example, and encouraging innovation, play a crucial role in developing and sustaining a favourable safety culture. This highlights the pivotal role of supervisors in shaping safety culture and underscores the need to align leadership practices with the organisation's values to create a safer and more productive work environment. Organisations that recognise and nurture this connection are better positioned to achieve their safety goals while improving the well-being and engagement of their workforce.

The results also demonstrated a significant positive effect of safety competency on safety culture in the Malaysian construction industry. When employees have a high level of safety competency, they actively contribute to the cultivation of a positive safety culture. This synergy underscores the critical significance of equipping employees with the knowledge and confidence required to ensure safety in the workplace. Organisations that prioritise both safety competency and a robust safety culture are positioned favourably to achieve safety objectives, enhance employee well-being, and foster a safer, more productive work environment. These efforts support overall organisational success and long-term sustainability.

6. CONCLUSION

The findings of this study highlight a significant relationship between safety leadership, safety competency, and their impact on safety culture within the Malaysian construction industry. These results show that organisational leaders' behaviours and actions influence safety culture. Moreover, they emphasise the importance of individual competencies in shaping behaviour, particularly those related to safety. Effective safety leadership enhances employees' awareness of their work environment, potential hazards, and the importance of safety protocols.

Employees with higher safety competencies are better equipped to identify hazards, assess risks, and implement safety measures, contributing to a strong safety culture. These findings highlight the need for construction contractors to prioritise safety leadership and invest in safety training and development initiatives. Such investments would empower employees to improve their safety competencies, ultimately fostering a robust safety culture. This emphasis on safety leadership and competency-building measures is vital for ensuring the well-being and protection of employees in the workplace. Additionally, these results provide a compelling rationale for contractors to allocate resources to these areas, recognising that a safety-focused organisational culture can yield far-reaching benefits. By cultivating a strong safety culture, contractors can create a safer work environment, reducing potential hazards and safeguarding employee welfare.

This study has opened several promising avenues for future research. First, a longitudinal research design could also be valuable in future investigations. By studying these contractors over an extended period, researchers would have gained a clearer understanding of how variables interrelate and evolve. This longitudinal approach could have yielded valuable insights into the dynamics and transformations occurring within the construction industry.

Finally, while this study relied primarily on quantitative research methods and survey questionnaires, future research should consider integrating qualitative methods. Conducting in-depth interviews can provide verbal descriptions and delve deeper into the characteristics, cases, and contextual factors.

7. ACKNOWLEDGEMENT

The authors express their sincere gratitude to **Universiti Putra Malaysia** for providing the necessary resources and support to complete this study. We also thank all participants for contributing their time and insights to this research. Special appreciation is extended to colleagues and peers who offered valuable feedback during the development of this manuscript.

REFERENCES

- Abas, N. H., Yusuf, N., Suhaini, N. A., Kariya, N., Mohammad, H., & Hasmori, M. F. (2020). Factors affecting safety performance of construction projects: A literature review. *IOP Conference Series: Materials Science and Engineering*, 713(1), 1–9. <https://doi.org/10.1088/1757-899X/713/1/012036>
- Akhtar, W., Ghufuran, H., Husnain, M., & Shahid, A. (2017). The effect of emotional intelligence on employees' job performance: The moderating role of perceived organisational support. *Journal of Accounting & Marketing*, 6(3), 2–8. <https://doi.org/10.4172/2168-9601.1000243>

- Atikasari, C. D., Sudiarno, A., & Priyanto, E. (2022). The effect of safety leadership, safety culture, and safety behaviour on safety performance after a company merger: A case study. *Jurnal Sistem dan Manajemen Industri*, 6(2), 187–199. <https://doi.org/10.30656/jsmi.v6i2.5051>
- Cho, S. M., & Choi, J. (2018). Patient safety culture is associated with patient safety competencies among registered nurses. *Journal of Nursing Scholarship*, 50(5), 549–557. <https://doi.org/10.1111/jnu.12413>
- Cooper, D. (2010). Safety leadership: Application in a construction site. *Italian Journal of Occupational Medicine and Ergonomics*, 32(1 Suppl. A), A18–A23.
- Cooper, D., & Psychol, C. C. (2016). *Navigating the safety culture construct: A review of the evidence*. https://www.behavioral-safety.com/articles/safety_culture_review.pdf
- Occupational Safety and Health Administration. (n.d.). *Occupational accident statistics*. <https://www.dosh.gov.my/index.php/ms/statistic-v/occupational-accident-statistics-v>
- Díaz-Cabrera, D., Hernández-Fernaud, E., & Isla-Díaz, R. (2007). An evaluation of a new instrument to measure organisational safety culture values and practices. *Accident Analysis & Prevention*, 39(6), 1202–1211. <https://doi.org/10.1016/j.aap.2007.03.005>
- Du, X., & Sun, W. (2012). Research on the relationship between safety leadership and safety climate in coal mines. *Procedia Engineering*, 45, 214–219. <https://doi.org/10.1016/j.proeng.2012.08.146>
- Fewster, A. (2018). *Safety leadership: A review of management trends*. https://www.researchgate.net/publication/331326955_Safety_Leadership_A_Review_of_Management_Trends
- Feliciano, E. E., Feliciano, A. Z., Maniago, J. D., Gonzales, F., Santos, A. M., Albougami, A., Ahmad, M., & Al-Olah, H. (2021). Nurses' competency in the Saudi Arabian healthcare context: A cross-sectional correlational study. *Nursing Open*, 8(5), 2773–2783. <https://doi.org/10.1002/nop2.853>
- Flin, R., & Yule, S. (2004). Leadership for safety: Industrial experience. *BMJ Quality & Safety*, 13(Suppl. 2), ii45–ii51. <https://doi.org/10.1136/qshc.2003.009555>
- Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 18(3), 382–388.
- Giesecke, J., & McNeil, B. (1999). Core competencies and the learning organisation. *Faculty Publications, UNL Libraries*, 60.
- Grill, M., & Nielsen, K. (2019). Promoting and impeding safety – A qualitative study into direct and indirect safety leadership practices of construction site managers. *Safety Science*, 114, 148–159. <https://doi.org/10.1016/j.ssci.2019.01.008>
- Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modelling (PLS-SEM): An emerging tool in business research. *European Business Review*, 26(2), 106–121. <https://doi.org/10.1108/EBR-10-2013-0128>
- Han, Y., Kim, J. S., & Seo, Y. (2020). Cross-sectional study on patient safety culture, patient safety competency, and adverse events. *Western Journal of Nursing Research*, 42(1), 32–40. <https://doi.org/10.1177/0193945919838990>

- Haukelid, K. (2008). Theories of (safety) culture revisited – An anthropological approach. *Safety Science*, 46(3), 413–426. <https://doi.org/10.1016/j.ssci.2007.05.014>
- Indrayana, D. V., Pribadi, K. S., Marzuki, P. F., & Iridiastadi, H. (2022, July). Factors affecting the safety leadership of construction project owners in Indonesia. *IOP Conference Series: Earth and Environmental Science*, 1065(1), 012003. <https://doi.org/10.1088/1755-1315/1065/1/012003>
- Ishak, N., & Azizan, M. A. (2018, February). A review of the benchmarking concept in Malaysian construction safety performance. *AIP Conference Proceedings*, 1930(1), 020024-1–020024-5. <https://doi.org/10.1063/1.5022918>
- Khasanah, N., Kholil, K., & Sugiarto, S. (2019). Analyse the effect of leadership on safety climate, safety culture and safety performance. *Asian Journal of Advanced Research and Reports*, 4(2), 1–12. <https://doi.org/10.9734/ajarr/2019/v4i230106>
- Kim, J. M. (2019). Multicollinearity and misleading statistical results. *Korean Journal of Anesthesiology*, 72(6), 558–569. <https://doi.org/10.4097/kja.19087>
- Kim, T. E., Sydnnes, A. K., & Batalden, B. M. (2021). Development and validation of a safety leadership self-efficacy scale (SLSES) in the maritime context. *Safety Science*, 134, 105031. <https://doi.org/10.1016/j.ssci.2020.105031>
- Krause, T. R. (2005). *Leading with safety*. John Wiley & Sons.
- Lee, S. E., Lee, M. H., Peters, A. B., & Gwon, S. H. (2020). Assessment of patient safety and cultural competencies among senior baccalaureate nursing students. *International Journal of Environmental Research and Public Health*, 17(12), 4225. <https://doi.org/10.3390/ijerph17124225>
- Luria, G., & Morag, I. (2012). Safety management by walking around (SMBWA): A safety intervention program based on both peer and manager participation. *Accident Analysis & Prevention*, 45, 248–257. <https://doi.org/10.1016/j.aap.2011.07.010>
- Magalhães, M. C. R., Jordão, F., & Costa, P. (2022). The mediator role of the perceived working conditions and safety leadership on the relationship between safety culture and safety performance: A case study in a Portuguese construction company. *Análise Psicológica*, 40(1), 81–99.
- Marcos, A., García-Ael, C., & Topa, G. (2020). The influence of work resources, demands, and organisational culture on job satisfaction, organisational commitment, and citizenship behaviours of Spanish police officers. *International Journal of Environmental Research and Public Health*, 17(20), 7607. <https://doi.org/10.3390/ijerph17207607>
- May, N. C., Batiz, E. C., & Martinez, R. M. (2019). Assessment of leadership behaviour in occupational health and safety. *Work*, 63(3), 405–413. <https://doi.org/10.3233/WOR-192946>
- Mazzuto, G., Antomarioni, S., Marcucci, G., Ciarapica, F. E., & Bevilacqua, M. (2022). Learning-by-doing safety and maintenance practices: A pilot course. *Sustainability*, 14(15), 9635. <https://doi.org/10.3390/su14159635>
- Mirabile, R. J. (1997). Everything you wanted to know about competency modelling. *Training & Development*, 51(8), 73–78.
- Mohammadi, A., Tavakolan, M., & Khosravi, Y. (2018). Factors influencing safety performance on construction projects: A review. *Safety Science*, 109, 382–397. <https://doi.org/10.1016/j.ssci.2018.06.017>

- Mostafa, S. A., & Ahmad, I. A. (2018). Recent developments in systematic sampling: A review. *Journal of Statistical Theory and Practice*, 12(2), 290–310. <https://doi.org/10.1080/15598608.2017.1353456>
- Nawi, M. N. M., Ibrahim, S. H., Affandi, R., Rosli, N. A., & Basri, F. M. (2016). Factors affecting safety performance construction industry. *International Review of Management and Marketing*, 6(8), 280–285.
- Oah, S., Na, R., & Moon, K. (2018). The influence of safety climate, safety leadership, workload, and accident experiences on risk perception: A study of Korean manufacturing workers. *Safety and Health at Work*, 9(4), 427–433. <https://doi.org/10.1016/j.shaw.2018.01.008>
- Odu, J. O., Rahmawati, H. T., & Juliana, J. (2018). Safety culture among the staff at a public university in Malaysia. *International Journal of Public Health and Clinical Sciences*, 5(4), 161–174.
- Okwel, M., Alinaitwe, H., & Kalumba, D. (2019). Health and safety performance in the Ugandan construction industry. In *Construction health and safety in developing countries* (pp. 103–115). Routledge.
- Salleh, A. (2010). *Safety behaviour in the Malaysian petrochemical industry* (Unpublished doctoral dissertation). Universiti Utara Malaysia.
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modelling. In *Handbook of market research* (pp. 587–632). Springer International Publishing.
- Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7th ed.). Pearson Education Limited.
- Sekaran, U., & Bougie, R. (2016). *Research methods for business* (7th ed.). John Wiley & Sons Ltd. https://doi.org/10.1007/978-94-007-0753-5_102084
- Setiono, B. A., Brahmasari, I. A., & Mujanah, S. (2018). Effect of safety culture, safety leadership, and safety climate on employee commitments and employee performance PT. Pelindo III (Persero) East Java province. *Sebelas Maret Business Review*, 3(1), 6–10. <https://doi.org/10.20961/snbr.v3i1.13680>
- Stiles, S., Ryan, B., & Golightly, D. (2018). Evaluating attitudes to safety leadership within rail construction projects. *Safety Science*, 110, 134–144. <https://doi.org/10.1016/j.ssci.2017.12.030>
- Van Nunen, K., Li, J., Reniers, G., & Ponnet, K. (2018). Bibliometric analysis of safety culture research. *Safety Science*, 108, 248–258. <https://doi.org/10.1016/j.ssci.2017.08.011>
- Wamuziri, S. (2006, September). Safety culture in the construction industry. In *Proceedings of the Institution of Civil Engineers-Municipal Engineer*, 159(3), 167–174.
- Wang, J. M., Liao, P. C., & Yu, G. B. (2021). The mediating role of job competence between safety participation and behavioural compliance. *International Journal of Environmental Research and Public Health*, 18(11), 5783. <https://doi.org/10.3390/ijerph18115783>
- Woodruffe, C. (1993). What is meant by a competency? *Leadership & Organisation Development Journal*, 14(1), 29–36. <https://doi.org/10.1108/eb053651>
- Wu, C., Li, N., & Fang, D. (2017). Leadership improvement and its impact on workplace safety in construction projects: A conceptual model and action research. *International Journal of Project Management*, 35(8), 1495–1511. <https://doi.org/10.1016/j.ijproman.2017.08.013>
- Wu, T. C., Chen, C. H., & Li, C. C. (2008). A correlation among safety leadership, safety climate and safety performance. *Journal of Loss Prevention in the Process Industries*, 21(3), 307–318. <https://doi.org/10.1016/j.jlp.2007.11.001>

- Wu, T. C., Lin, C. H., & Shiau, S. Y. (2010). Predicting safety culture: The roles of employer, operations manager and safety professional. *Journal of Safety Research*, 41(5), 423–431. <https://doi.org/10.1016/j.jsr.2010.06.006>
- Yang, L., Bashiru Danwana, S., Issahaku, F. L. Y., Matloob, S., & Zhu, J. (2022). Investigating the effects of personality on the safety behaviour of gold mine workers: A moderated mediation approach. *International Journal of Environmental Research and Public Health*, 19(23), 16054. <https://doi.org/10.3390/ijerph192316054>