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

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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 the 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 carried out using SmartPLS 4. The study's 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 prioritize safety leadership and allocate resources to safety training and development initiatives. By enhancing employees' safety competencies, organizations can contribute to the establishment of a robust safety culture, ultimately addressing the industry's safety challenges. This research sheds light on crucial factors that can contribute to improving safety outcomes in the Malaysian construction industry.

ARTICLE INFO

Keywords:

Safety competency, safety culture, safety leadership

1.0 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 [1]. It is consistently reporting high rates of workplace accidents, including fatalities, permanent disabilities, and non-permanent disabilities [2][3]. 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 [4].

Research has consistently demonstrated that a strong safety culture significantly contributes to improved safety performance [5][6]. 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 [7]. Meanwhile, safety leadership had a substantial impact on safety culture, and in turn, safety culture significantly influenced safety performance [8]. Safety competency holds paramount importance across various industries, directly impacting both individual well-being and overall organizational success [9].

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.

2.0 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 [10]. Safety culture should not exist as a separate entity but be an integral part of the overall organizational culture [11]. 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 [12].

The establishment of a robust safety culture is vital for reducing workplace incidents and hazards, particularly in high-risk industries like agriculture and construction [13]. However, recent attention has shifted towards healthcare and patient safety culture, taking precedence over the subdomain of organizational safety culture [14].

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 [15]. Occupational health and safety leadership plays a pivotal role in safeguarding employee well-being, mitigating workplace risks, and preventing job-related injuries or illnesses [16]. 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 [17].

Leadership is considered indispensable for cultivating a positive and goal-oriented health and safety culture [18] It plays a crucial role in instilling safety values at work, ultimately leading to a reduction in workplace accidents [19]. Conversely, the absence of effective leadership is identified as a significant contributor to persistently high accident rates in

construction projects [20]. 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 [21]. These leadership behaviors impact subordinates' motivation, expectations, and, consequently, their safe or unsafe conduct [22].

In the construction industry, front-line management holds significant influence due to its proximity to the workforce, which enhances managerial effectiveness [23]. Leaders who exhibit effective safety leadership styles foster trust and cooperation among their followers [24]. Supervisors demonstrating strong safety leadership directly influence employees' risk perceptions, safety awareness, adherence to safety procedures, participation in safety measures, and overall safety compliance [25]. Key leadership behaviors that positively impact safety include continuous planning and coordination, role modeling, work monitoring, and proactive deviation correction [26]. 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 [16]. 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 [27]. 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 [28]. Other studies, reveal a marginal but significant effect of leadership on safety culture [29], and safety leadership negatively impacts the organization’s safety culture. [30]. Based on these arguments, the following hypothesis is posited:

H1: There is a significant effect between safety leadership and 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 [31]. Competency includes knowledge, skills, abilities, and traits linked to superior job performance, such as problem-solving and leadership [32]. Competency is also defined as the combination of skills, knowledge, and personal attributes contributing to an individual's success in a specific role [33].

Safety competency is of paramount importance across industries, directly impacting individual well-being and organizational success [9]. 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 [34]. Safety participation, job competence, and behavioral compliance are interconnected, with enhanced competence contributing to overall safety performance and adherence to safety protocols [34]. A lack of safety competency in high-risk industries can lead to catastrophic consequences and numerous injuries [9]. Organizations must prioritize safety competency by providing training and support to ensure employees' proficiency in implementing safe practices [35].

In healthcare, nurses' competence in patient safety is critical for minimizing harm and ensuring patient well-being [36]. Nurses need knowledge about patient safety concerns, preventive measures, and the ability to respect patients' values and beliefs [36]. Registered nurses who embrace a robust safety culture are more likely to exhibit competence in patient safety [37]. Nurses' competencies play a pivotal role in mitigating adverse events and supporting a patient safety culture [38]. To uphold safety standards and deliver quality patient care, organizations must prioritize nurses' professional competence [39]. This includes emphasizing teamwork, leadership, and ongoing education [37].

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 between safety competency and 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 within the Malaysian construction industry context. As a result, this research serves as a valuable addition to the current body of knowledge and industry 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 within the construction industry. In essence, this study addresses a critical research gap and underscores the importance of enhancing safety practices within the construction industry in Malaysia.

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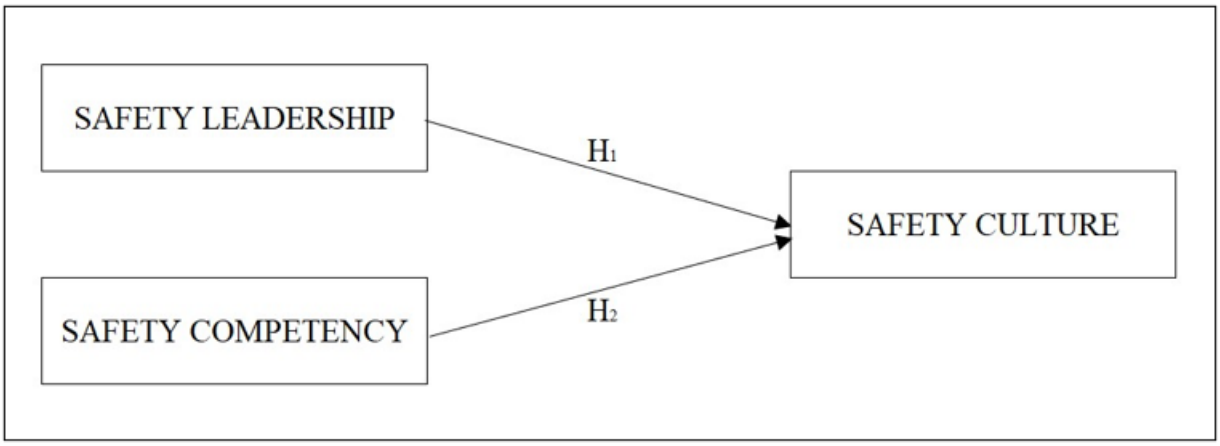

Figure 1: Research Framework

3.0 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 [40]. 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 [41], 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 [42].

For data analysis, SmartPLS4 was used. Partial least squares structural equation modeling (PLS-SEM) was chosen due to its suitability for estimating complex path models involving latent variables and their relationships [43]. PLS path modeling was considered more appropriate for complex models, particularly those with real-world applications, enabling more accurate predictions [44].

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 [45]. 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 [46]. 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 [47]. 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.

4.0 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 [48]. 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 [49].

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 [50]. 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 [51]. 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 [50] (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 [42]. 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 [50]. When a latent construct was unique and captured phenomena not represented by other constructs, it indicated the establishment of discriminant validity [50]. Two methods for assessing discriminant validity [50], 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 [50]. 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 [50]. 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 [50].

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

Hypo - theses	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

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5.0 DISCUSSION

This study demonstrated the significant positive effect of safety leadership on safety culture in 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 the 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 result also demonstrated a significant positive effect of safety competency on safety culture in Malaysian construction industry. When employees possess 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 their work. Organisations that prioritise both safety competency and a robust safety culture position themselves favourably to achieve safety objectives, enhance employee well-being, and foster a safer, more productive work environment. These efforts, in turn, support overall organisational success and long-term sustainability.

6.0 CONCLUSION

The study's findings highlight a significant connection between safety leadership and safety competency and their impact on safety culture within the Malaysian construction industry. These results shows that organisational leaders' behaviours and actions, influence safety culture. It is also emphasising the importance of individual competencies in shaping behaviors, 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 their employees' welfare.

This study has opened up several promising avenues for future research. Firstly, a longitudinal research design could have also proven 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 over time. 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 might consider integrating qualitative methods. Conducting in-depth interviews could provide verbal descriptions and delve deeper into the characteristics, cases, and contextual factors.

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