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The Malaysian Construction Mosaic: Unraveling Safety Commitment's Role in Safety Culture



Abstract: - In Malaysia, the construction industry held the unenviable fifth position for accidents occurring between 2017 and 2021, and it witnessed the highest number of fatal workplace injuries in comparison to other industries. The purpose of this study was to investigate the effect of safety commitment on safety culture and examine if self-efficacy mediates the relationship between safety competency and safety culture in the Malaysian construction industry. Data were collected from 385 supervisors, engineers and project managers of Grade G7 contractors who were registered with the Malaysian Construction Industry Development Board (CIDB) in four states in peninsular of Malaysia, using systematic random sampling method and analysed using SmartPLS 4. The results revealed that safety commitment has a significant effect on safety culture, and self-efficacy played a significant mediating role within this relationship.

Keywords: Safety commitment, safety culture, self-efficacy.

I. INTRODUCTION

The construction industry holds a central position in a nation's economic landscape, significantly impacting its gross domestic product (GDP). The construction industry plays a vital role in driving the Malaysia's economic growth by spearheading the development of critical infrastructure, including highways, airports, ports, residential and commercial properties [1]. Moreover, it serves as a catalyst for the growth of associated industries such as building materials, machinery, equipment, and professional services. The construction industry relies on interconnections with manufacturing, transportation, and financial sectors for supplies, equipment, transportation, and financial support. Conversely, it also generates substantial demand for these industries, thereby contributing to economic growth and the creation of employment opportunities.

However, it is crucial to note that the construction industry consistently grapples with high rates of workplace accidents, encompassing fatalities, permanent disabilities, and non-permanent disabilities. Statistics from the Department of Occupational Safety and Health (DOSH) in Malaysia reveal that from 2017 to 2021, construction-related accidents and fatalities in the country remained alarmingly high, with the fatality rate comprising between 26% to 51% of all accidents [2]. Research conducted has demonstrated a direct link between a deficient workplace safety culture and an increase in work-related accidents [3] and study focusing on the Malaysian construction industry underscored the hindrance posed by subpar safety cultures to overall safety performance in the industry [4].

In general, there is evident that safety commitment can exert a significantly positive influence on safety culture. Research have suggested that individual commitment represents a critical facet of safety culture and can wield a substantial impact on safety performance [5]. In the context of current research, safety culture, safety competency, and self-efficacy questionnaires were administered to employees employed by Grade G7 contractors in Malaysia. The principal aim of this study is to explore the effects of safety competency on safety culture and to investigate the mediating role of self-efficacy in this relationship within the Malaysian construction industry.

II. LITERATURE REVIEW AND HYPOTHESIS

2.1. Safety Culture

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The concept of safety culture made its debut in 1986 during the investigation of the Chernobyl disaster in Ukraine. The inquiry into the Chernobyl catastrophe unveiled substantial shortcomings in organisational safety. It was in the summary report on the Post-Accident Review Meeting on the Chernobyl Accident by the International Nuclear Safety Group (INSAG) that the term "safety culture" was initially introduced, describing a collection of organisational factors linked to safety [6].

Subsequently, in 1991, the International Atomic Energy Agency (IAEA) presented a definition of safety culture as "the assembly of characteristics and attitudes within organisations and individuals that ensures that nuclear plant safety issues are accorded the attention commensurate with their significance" [7]. According to the IAEA's perspective, a safety culture encompasses two primary components: the structure established by organisational policies and management actions, and the mindset of employees at all levels regarding their engagement with and benefits from this structure [7]. However, the development of a safety culture hinges not only on the framework set by policies and management but also on the dedication and competence of individuals themselves. Safety culture then defined safety culture as the collection of employees' attitudes, beliefs, perceptions, and values concerning workplace safety [8]. To provide a comprehensive evaluation of safety culture, it is imperative to consider both the facets of the safety management system and psychosocial factors such as shared values, beliefs, and interpretations [9].

2.2. *Safety Commitment and Safety Culture*

Safety commitment, characterised as an individual's active engagement in safety-related activities, which signifies a robust acceptance of the organisation's safety objectives and a readiness to invest effort in improving workplace safety [10]. This commitment significantly shapes how individuals embrace company safety initiatives and their personal approach to safety in the workplace [11]. To put it more simply, safety commitment is an individual's proactive involvement in safety tasks aimed at achieving the organisation's safety objectives and enhancing workplace safety performance [12]. A multitude of prior studies underscore the significance of safety commitment and its direct influence on safety performance [13]. The absence of safety commitment has been recognised as a substantial impediment to employees' willingness to contribute to improved safety performance [14]. Employees' safety commitment is manifested in their safety attitudes and behaviours, which are assessed through their compliance with safety measures and active participation in promoting safety at work [11] [15].

Although substantial research has delved into the realm of management safety commitment [16], there is a noticeable void in the literature when it comes to individual employee safety commitment [17] [18]. Despite the equal recognition of the importance of both management commitment and individual employee safety commitment by researchers, the limited exploration of the latter has left a gap in the existing body of literature. Safety commitment has a pivotal role as a cornerstone for establishing an effective safety culture within an organisation [19], and specifically individual commitment as a fundamental element of safety culture [20][21]. Based on these arguments, we propose the following hypothesis:

H₁: There is a significant effect between safety commitment and safety culture.

2.3. *Safety Self-Efficacy as a Mediator*

Self-efficacy, encompasses an individual's collection of beliefs about their capabilities, influencing how effectively they can execute a plan of action in hypothetical situations [22]. This perceived self-efficacy reflects an individual's confidence in their ability to perform at a level that can impact outcomes that hold personal significance [23].

Self-efficacy often serves as a mediator between independent and dependent variables. For instance, self-efficacy plays a crucial mediating role, because empowering leadership doesn't directly affect subordinates' behavioural responses [24]. Similarly, a positive correlation between academic success and grit, mediated by self-efficacy and achievement orientation goals [25]. In other research self-efficacy played a mediating role in the relationship between job performance and safety compliance [26]. Similarly, other research discovered the mediating factor of self-efficacy in the relationship between safety stressors (safety role ambiguity, safety role conflict, and interpersonal safety conflict) and safety performance [27].

However, in the realm of safety culture research, there's a noticeable scarcity of studies that utilise self-efficacy as a mediator. The absence of mediation on safety commitment and safety culture, as such, self-efficacy could be tested as the mediator in this relationship. Thus, the following hypotheses were developed:

H₂: Self-efficacy mediates the relationship between safety commitment and safety culture.

The research framework establishes a connection between safety commitment, self-efficacy, and safety culture, as depicted in Figure 1. Through a comprehensive review of existing literature, this study identifies a gap, specifically the lack of study on (individual) safety commitment and the absence of mediation effect of self-efficacy on its relation with safety culture, especially 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 commitment have the potential to exert significant positive influences on safety culture, while self-efficacy mediates the relationship.

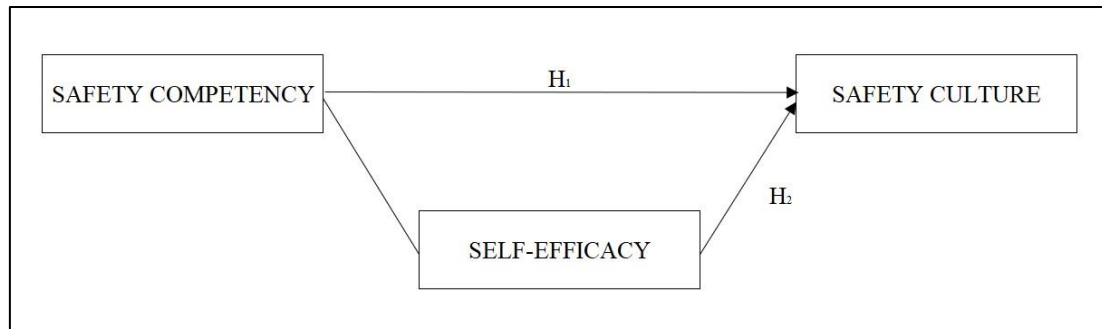


Figure 1: Research Framework

III. METHODS

3.1. Sample and Procedure

This study aimed to contribute original insights to the field and adopted a quantitative research approach rooted in the positivist paradigm to achieve generalisability of results. Data collection involved the utilisation of a cross-sectional survey, and participants were selected through systematic random sampling, a method renowned for its efficiency in sample selection and its ability to provide reliable estimations [28]. The study's target population consisted of 6,103 Grade G7 contractors registered with the Malaysian Construction Industry Development Board (CIDB) in the regions of Selangor, Kuala Lumpur, Johor, and Pulau Pinang. Pertinent information about these contractors, including their contact details, was accessible on the Malaysian CIDB website. The criteria for selecting the sample were established based on the guidelines provided by [29]. Data were collected from individuals in roles such as supervisors, engineers, and project managers, all of whom hold critical positions at construction project sites. The data collection process involved the use of a 5-point Likert scale.

To collect data efficiently and cost-effectively, Google Forms and self-reported survey questionnaires were employed. The survey's URL was distributed via email directly to the participants, accompanied by regular reminders to encourage participation. Email served as the primary distribution method, with an assurance of respondents' responses remaining confidential. Additionally, participants were offered the option to reach out to the researcher directly through phone, email, or WhatsApp if necessary. Participation in the survey was entirely voluntary. A total of 1,110 questionnaires were emailed to contractors, resulting in 385 responses, which translated to a response rate of 34.68%. This rate was considered acceptable, particularly in consideration of the typically low response rates observed in survey research. In many cases, a response rate of 30% is viewed as acceptable, and sometimes even commendable [30].

For the analysis of the collected data, the study employed SmartPLS4. The choice of Partial Least Squares Structural Equation Modelling (PLS-SEM) was made due to its suitability for estimating complex path models involving latent variables and their interrelationships [31]. PLS path modelling was deemed more fitting for intricate models, especially those with practical applications, as it enabled more accurate predictions [32].

3.2. Measures

This study investigates the relationships between safety commitment and safety culture, along with the mediating impact of self-efficacy. 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 commitment (10 items), and self-efficacy (10 items). These questionnaire items are adopted, adapted, and validated based on previous studies in the field.

The Safety Culture Scale (SCU) utilised in this study is for assessing safety culture [33]. The scale's reliability is demonstrated with a Cronbach's Alpha value of 0.949, exceeding the recommended threshold. Respondents express

their opinions using a 5-point Likert scale, with response options ranging from "Strongly Disagree = 1" to "Strongly Agree = 5". The SCU survey instrument consists of a total of twelve (12) items (Author, Year).

For the measurement of safety commitment, the Safety Commitment Scale (SCM) is employed, which is a ten-items scale [34]. The scale's reliability is confirmed with a Cronbach's Alpha of 0.924. Similar to the SCU, respondents indicate their responses on a 5-point Likert scale.

To assess self-efficacy, the Self-Efficacy Scale (SE) is utilised, consisting of ten items [35]. The reliability of this scale is indicated by a Cronbach's Alpha value of 0.924. As with the other scales, respondents rate their responses on a 5-point Likert scale.

IV. RESULTS

4.1. Hypothesis Testing and Results Analysis

In order to verify the absence of multicollinearity, the dataset was assessed by calculating tolerance values and 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 [36]. These thresholds served as guidelines to determine the presence or absence of multicollinearity in the analysis.

SmartPLS4 was utilised for this study. The PLS-SEM comprised two primary stages. The initial phase, known as the measurement model, centred 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 recognised in the measurement model and to conduct hypothesis testing [37].

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 [38]. In this study, items with outer loadings above 0.6 were retained. For internal consistency, the composite reliability (CR) index was calculated by Fornell-Larcker criterion [39]. 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 [38] (See Table 2).

Construct validity referred to the extent to which the outcomes derived from a measurement aligned with the underlying concepts that the study aimed to investigate [30]. 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) as recommended by Hair et al. (2014) (Table 2). Safety Culture items (SCU1 to SCU12) displayed substantial factor loadings (0.745 to 0.911), AVE of 0.702, and CR of 0.966. Safety Commitment items (SCM1 to SCM10) also exhibited moderate to strong factor loadings (0.614 to 0.926), AVE of 0.656, and CR of 0.950. Self-Efficacy demonstrated high factor loadings (0.739 to 0.876), AVE of 0.669, and CR of 0.953.

Discriminant validity referred to the degree to which a specific latent construct differed from other latent constructs [38]. When a latent construct was unique and captured phenomena not represented by other constructs, it indicated the establishment of discriminant validity [38]. Two methods for assessing discriminant validity [38], 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 [38]. 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 Commitment, Safety Culture and Self-Efficacy were approximately 0.810, 0.838, and 0.818, 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 [38]. 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 [38].

R2 represented the coefficient of determination and indicated the proportion of variance in the dependent variable (Safety Culture) and mediating variable (Self-Efficacy) that could be explained by the independent variables (Safety Commitment). In this case, the R2 value for Safety Culture was 0.302, suggesting that approximately 30.26% of the variance in Safety Culture could be accounted for by the independent variables in the model. R2 value for Self-Efficacy was 0.319, suggesting that approximately 31.9% of the variance in Self-Efficacy 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 0.233 and Self-Efficacy value of Q2 was 0.312 indicating that the model had moderate 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 and an endogenous variable. Safety Commitment had an f2 value of 0.096, indicating a moderate effect on Safety Culture, and an f2 value of 0.467 indicating strong effect on Self-Efficacy. Meanwhile Self-Efficacy had an f2 value of 0.093 indicating moderate 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 Commitment and Safety Culture. The original sample value was 0.313, with a sample mean of 0.313 and a standard deviation of 0.052. The T statistic was calculated as 5.987, indicating 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 positive significant relationship between Safety Commitment and Safety Culture.

Hypothesis 2 (H2) examined the mediation effect of self-efficacy on Safety Commitment and Safety Culture. The information presented in Table 5 allowed for the identification of mediation effects through the examination of the bootstrapping results for indirect effects. Typically, the Standard Deviations were evaluated by analysing the bootstrapped results of the indirect effects (i.e., bootstrapped AB). Additionally, the T-values were determined by dividing the product of A and B by the Standard Deviation. This approach, provided a means to assess the significance of the mediation effects. The results from the table indicated that the relationships between Safety Commitment (SCM), and Self-Efficacy (SE) had significant indirect effects on Safety Culture (SCU). The beta coefficients for Path A (SCM -> SE) was 0.564, while the beta coefficient for Path B (SE -> SCU) was 0.309. The indirect effects, calculated as the product of the beta coefficients (A*B), was 0.174276. These indirect effects suggested that Self-Efficacy mediated the relationships between Safety Commitment and Safety Culture. The T-statistics was 5.181 indicated the strength of the effects relative to the variability in the data. Furthermore, the p-value was below the significance level of 0.05, indicating their statistical significance. Therefore, it could be concluded that Self-Efficacy played a mediating role in the relationships between Safety Commitment and Safety Culture.

Table 1: Collinearity Statistics of Variables

Variable	Tolerance	VIF
Safety Commitment	1.000	1.000

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	0.864	0.702	0.966
	SCU2	0.759		

Construct	Item	Loading	Average Variance Extracted (AVE)	Composite Reliability (CR)
	SCU3	0.909		
	SCU4	0.827		
	SCU5	0.874		
	SCU6	0.909		
	SCU7	0.888		
	SCU8	0.911		
	SCU9	0.787		
	SCU10	0.806		
	SCU11	0.745		
	SCU12	0.751		
Safety Commitment (SCM)	SCM1	0.614	0.656	0.950
	SCM2	0.806		
	SCM3	0.748		
	SCM4	0.880		
	SCM5	0.877		
	SCM6	0.845		
	SCM7	0.872		
	SCM8	0.926		
	SCM9	0.768		
	SCM10	0.719		
Self-Efficacy (SE)	SE1	0.753	0.669	0.953
	SE2	0.776		
	SE3	0.739		
	SE4	0.779		
	SE5	0.839		
	SE6	0.863		
	SE7	0.855		
	SE8	0.848		
	SE9	0.876		
	SE10	0.838		

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

Construct	SCM	SCU	SE
Safety Commitment (SCM)	0.810		
Safety Culture (SCU)	0.487	0.838	
Self-Efficacy (SE)	0.564	0.485	0.818

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 Commitment - > Safety Culture	0.313	0.313	0.052	5.987	0.000	Supported

Table 5: Structural Model: Bootstrapping Results for Indirect Effect

Path A	Beta	Path B	Beta	Indirect Effect (A*B)	Standard Deviation (STDEV)	T Statistics	P Values
SCM -> SE	0.564	SE->SCU	0.309	0.174276	0.034	5.181	0.000

Table 6: Structural Model: Test of Significance for Mediating Relationships

Hypo - theses	Relationship	Indirect Effect (A*B)	Standard Deviation (STDEV)	T Statistics	P Values	Decision
H ₂	Safety Commitment -> Self-Efficacy -> Safety Culture	0.174276	0.034	5.181	0.000	Supported

V. DISCUSSION

This study demonstrated there is significant effect of safety commitment on safety culture in Malaysian construction industry. When employees demonstrate a strong commitment to safety, it should directly contribute to the development and improvement of a positive safety culture within the organisation. Employees who express concern about hazards and risks align with the organisation's values regarding the strict observance of safety rules and procedures. A commitment to safety includes recognising the importance of near-miss incidents, which correlates with valuing the involvement of all workers in the collection of incident and accident information. Employees who willingly invest extra effort to be competent workers contribute to the collaborative environment fostered by the organisation. Employees who cooperate with supervisors on safety issues align with the organisation's values of collaboration and participation in promoting safety.

The findings also revealed that self-efficacy played a pivotal role in mediating the connection between safety commitment and safety culture. Safety commitment represents how dedicated employees are to safety in their work behaviours and attitudes. When employees demonstrate a strong commitment to safety, they actively participate in safety-related activities, adhere to safety protocols, and contribute actively to a safer work environment. Once self-efficacy is strengthened by this safety commitment, it exerts a significant influence on the organisation's safety culture, resulting in heightened engagement. Employees with high self-efficacy perceive their contributions as valuable and believe they can make a difference in terms of safety. Consequently, this leads to increased involvement in safety initiatives, reporting of safety concerns, and collaborative efforts to enhance safety practices. It fosters a positive attitude towards the safety culture, as high self-efficacy empowers employees to willingly embrace safety as a fundamental value. They become more open to safety rules and procedures, recognising their importance in creating a secure work environment. Furthermore, self-efficacious employees exhibit resilience when confronted with safety challenges, remaining confident in their ability to handle unexpected events, address safety-related issues, and adapt to evolving safety requirements. This resilience promotes a culture where employees proactively seek solutions rather than being discouraged by obstacles.

VI. CONCLUSION AND RECOMMENDATIONS

The results of the study emphasise the significant positive influence of safety commitment on the safety culture prevalent in the Malaysian construction industry. Self-efficacy plays an additional role by mediating the connection between an individual's safety commitment and the overall safety culture.

However, it's essential to recognise various limitations inherent in this study. To begin with, the study exclusively concentrated on grade G7 contractors, prompting concerns about the generalisability of these findings to other

contractor grades. While the insights gained in this specific context hold value, caution should be exercised when extrapolating these outcomes to diverse settings.

Despite these limitations, this study has paved the way for several promising avenues in future research. Firstly, by broadening the scope beyond grade G7 contractors in the construction industry, the applicability of the findings can be extended to contractors in various grades. This broader perspective would allow for the exploration of potential variations. Moreover, the data collected in this study primarily represented the viewpoints of supervisors, engineers, and managers, who occupy top-level management roles in site operations. To minimise potential bias and obtain a more comprehensive understanding, future research could incorporate a more diverse range of lower-level workers. This approach would provide insights into the perspectives and experiences of individuals at different organisational levels, enhancing our overall comprehension of the subject matter.

Finally, for a more profound understanding of the intricate relationship between safety commitment and safety culture, there may be a need for further investigation, potentially employing qualitative research methods. Qualitative research could facilitate a deeper comprehension of intricate and interactive relationships among variables in specific contexts, complementing the quantitative findings.

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