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Improving Workplace Safety Performance in Malaysian SMEs: The Role of Safety Compliance and Participation

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ABSTRACT: In the Malaysian context, small and medium enterprises (SMEs) experience a significant burden of workplace accidents. A consensus among scholars attributes a substantial portion of these incidents to human factors, particularly unsafe behaviors. This study, conducted in Malaysia's northern region, specifically targeted Safety and Health/Human Resource professionals within the manufacturing sector of SMEs. We gathered a robust dataset comprising 107 responses through a meticulously designed self-administered questionnaire. Employing advanced partial least squares-structural equation modeling (PLS-SEM) techniques with SmartPLS 3.2.9, we rigorously analyzed the data to scrutinize the intricate relationship between safety behavior and safety performance. The research findings unequivocally underscore the palpable and consequential impact of safety behavior variables, namely safety compliance and safety participation, on improving safety performance indicators such as accidents, injuries, and property damages. These results strongly validate research hypotheses. Consequently, this study highlights the pivotal significance of cultivating safety behavior among employees, particularly in resource-constrained SME settings, as an essential step toward enhancing workplace safety performance.

KEYWORDS :*Safety compliance, safety participation, safety performance, SME*

I. INTRODUCTION

Based on the statistics revealed by the Department of Occupational Safety and Health (DOSH), manufacturing sector contributes to the highest number of industrial accidents. As the overall data showed an increasing trend, small and medium enterprises (SME) sector was found to contribute 80% of the occupational accidents in Malaysia [1], [2]. According to the most recent systematic review, half of national accident cases originate from SMEs, where the likelihood of fatality is eight times higher [1].This statement aligns with prior research findings that have consistently identified unsafe working behaviour as the predominant contributor to workplace accidents over the years. Heinrich's seminal work in the 1940s demonstrated that unsafe behaviour accounted for 88% of industrial accidents, with the remaining percentage attributed to unsafe conditions and chance occurrences [3]. Subsequent studies have echoed this sentiment, emphasizing human factors, including risky behaviour, alongside engineering, technology, work system failures, and hazardous working conditions as primary predictors of industrial accidents [4], [5] . In the context of Malaysia's manufacturing industry, individual factors and unsafe acts such as circumventing safety protocols and neglecting personal protective equipment (PPE) emerge as the primary causes of accidents, followed by hazardous workplace conditions [6], [7].

Although scholars have reached a consensus on the role of safety behaviour in causing accidents[8]–[10], there is a limited availability of studies that comprehensively assess the impact of safety behaviour on accidents. Similarly, within the context of Malaysian SMEs, scholarly attention has been directed towards identifying the factors that influence safety behaviour [11]–[14]., yet there remains a dearth of studies investigating the direct association between safety behaviour and accidents.

Safety performance measurement is a crucial facet in the domain of occupational safety and health, encompassing several key dimensions. Initailly, scholars measured safety performance using accident/incident indicators. These incidents can vary in severity, from minor injuries to fatal outcomes, and are widely recognized as critical indicators of safety performance [4]. Nevertheless, contemporary research in the field has advocated for a shift towards a more proactive approach, emphasizing the measurement of safety performance through constructs such as safety behaviour[5], [9], [15]. While those scholars measure safety performance using behavioural elements, there is a subset of scholars employs accident rates, injury statistics, and property damage incidents as metrics to assess safety performance [16]–[18].

On the other hand, safety compliance and safety participation are integral components of safety behaviour, and their assessment provides valuable insights into an organization's safety performance and the effectiveness of safety management efforts. Researchers often explore these dimensions to understand their impact on safety outcomes and inform strategies for enhancing workplace safety [19], [20].

In the context of Malaysian manufacturing including SMEs, some scholars measure safety performance through safety behaviour dimensions, specifically safety compliance and safety participation [21], [22], while others employ safety performance indicators such as accidents, injuries, and losses related to goods and equipment [17], [18].

Heinrich's Domino Theory of workplace safety posits that accidents result from a sequence of events, starting with unsafe acts and substandard conditions at the base, followed by near-miss incidents, and culminating in accidents. This theory underscores the importance of addressing underlying factors to prevent workplace accidents [3]. Furthermore, Heinrich's research findings indicate that unsafe behaviour accounted for a substantial 88% of workplace accidents. Henceforth, this study aims to empirically investigate the impact of safety compliance and safety participation, integral dimensions of safety behaviour, on safety performance indicated by accidents, injuries and property losses, contributing to the ongoing discourse on enhancing workplace safety.

II. LITERATURE REVIEW

Workplace safety is a critical concern, especially for small and medium enterprises (SMEs) in Malaysia, where these businesses bear a disproportionate burden of workplace accidents. The human factor, particularly unsafe behaviors, has been identified as a significant contributor to these incidents.Understanding the relationship between safety behavior and safety performance is essential for developing effective strategies to mitigate workplace risks and enhance safety outcomes. This introduction sets the stage for exploring the impact of safety compliance and participation on improving workplace safety performance in Malaysian SMEs. By emphasizing the importance of cultivating positive safety behaviors, this study aims to provide actionable insights to promote a safer work environment in resource-constrained settings.

2.1 Safety Performance

An organization's safety performance can be evaluated by considering both leading and lagging indicators. Leading indicators can be measured via safety behaviors, while lagging indicators stem from incidents resulting in injuries or fatalities [11], [9]. It's observed that focusing on leading indicators tends to be more advantageous than relying solely on lagging ones [12], [13]. This is because safety performance using leading indicators tends to distribute more evenly, thus enabling more accurate evaluation links, forming a more substantiated basis for safety assessments and interventions. Lagging indicators, on the other hand, encompass factors such as the frequency of accidents, instances of equipment failure, losses in production, property damage, and personal injuries [14]. By evaluating both leading and lagging factors, a comprehensive understanding of accident reduction can be obtained.

2.2 Safety Behaviour

Safety behavior encompasses two key components: safety compliance and safety participation [11], [12]. Safety compliance is defined as the fundamental and necessary actions undertaken to uphold safety in the workplace, which may involve adhering to established work procedures and the usage of personal protective equipment. On the other hand, safety participation signifies behaviors aimed at fostering a safety-supportive work environment without directly impacting an individual's safety. This could manifest as voluntary involvement in safety-related activities, offering help to colleagues encountering safety concerns, and active participation in safety-focused meetings [12].

III. METHODOLOGY

This section outlines the methodology employed in this research. The details provided here ensure the rigor of the investigation, thereby contributing to the robustness and reliability of the research findings.

a. Research Framework and Hypothesis Development

Present research framework is designed to investigate the relationship between safety behaviour (comprising compliance and participation) and safety performance (measured through accident rates, injuries, property damage, and goods loss incidents). The justification for this framework is grounded in prior research and theory explained in the previous section, that consistently underscores the significance of safety behaviour in shaping safety outcomes and the established use of these safety performance indicators in the literature. For example, there is a recent study conducted among foreign construction general laborers in Hong Kong demonstrated that safety behaviour had a negative and significant effect on safety results, as evaluated by injury and near-miss rates [23]. Research framework is illustrated in Fig 1.

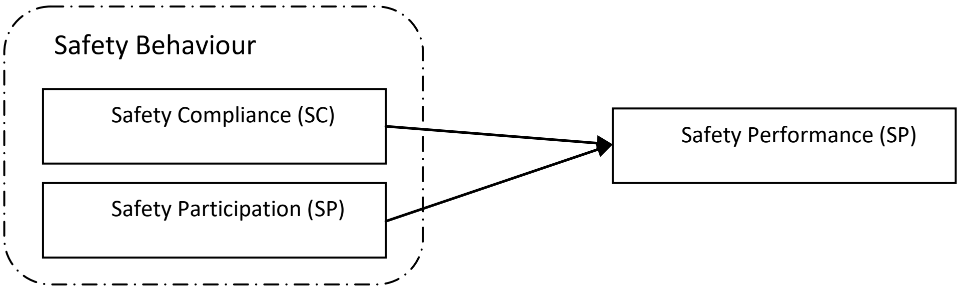

Figure 1. Research framework

Furthermore, based on the research framework, alternative hypotheses aredeveloped as follows:
H_1 : Safety Behaviour in terms of Safety Compliance has a significant effect on Safety Performance within SME Manufacturing Firms
H_2 : Safety Behaviour in terms of Safety Participation has a significant effect on Safety Performance within SME Manufacturing Firms

b. Research Instrument

A self-administered survey was applied for this research. The researcher drew from measurements used in preceding studies, tailoring and modifying them to align with the current research context. Further adjustments were made to these measurement items, which were then reviewed by experts in the field to ensure their accuracy and relevance. To augment comprehension among respondents, the instruments were translated into the Malay language. Before proceeding with the principal data collection, a pre-test was conducted to confirm the instrument's reliability, as well as face and content validity.

Respondents were requested to individually evaluate each items, utilizing a Likert scale that spanned from 1 (strongly disagree) to 5 (strongly agree). Detailed specifics concerning the utilized items are delineated in Table 1.

Table 1. Research Instrument's Construct

Items	Name of Variables	Number of Items	Source
1	Safety Performance (SPM)	4	
2	Safety Behaviour	3- Safety Compliance(SC) 3-Safety Participation(SP)	[19], [24]

c. Sample Size and Sampling Technique

G*Power is utilized to determine the sample size for several reasons. Firstly, it is a widely recognized and robust software tool commonly employed in the field of research methodology for power analysis (Faul et al., 2007). Power analysis is crucial in determining the adequacy of sample size to detect effects of a certain magnitude with a given level of confidence.In this research, a total of 107 participants, comprising safety and health officers, safety and health coordinators, safety and health representatives, as well as human resource officers, were engaged using purposive sampling method. The respondents represented SMEs located in the regions of Penang, Perlis, and Kedah. The determination of the sample size was facilitated through the use of G*Power 3.1.9.7, which yielded a minimum required sample size of 107 SMEs.

G*Power allows researchers to input various parameters such as effect size, alpha level (significance level), power level, and the number of predictors in the model [25], [26]. Based on these inputs, GPower calculates the required sample size needed to achieve sufficient statistical power for detecting the effects of interest. This ensures that the study has a high probability of detecting true effects, thereby enhancing the reliability and validity of the findings.

Additionally, G*Power facilitates sensitivity analysis, enabling researchers to assess the robustness of their results across different scenarios by varying key parameters [26]. This helps in evaluating the stability of the findings and making informed decisions regarding sample size adequacy.

Overall, the use of G*Power in determining sample size enhances the methodological rigor of the study, ensuring that the research findings are statistically sound and generalizable to the target population.

d. Data Analysis Method

For the purpose of this study, the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique using SmartPLS 3.2.9 software was employed to analyse the data. This sophisticated multivariate analysis method enabled us to explore the intricate connections among the independent variables (namely safety compliance and safety participation) and the dependent variable, safety performance. First, the measurement model was tested, followed by the structural model assessment to test the hypotheses [33].

IV. RESULTS AND DISCUSSIONS

This study conducted an assessment of measurement models to establish reliability, as well as discriminant and convergent validity. Furthermore, a rigorous evaluation of the structural model was carried out for the purpose of hypothesis testing, thereby enhancing the scientific rigor of the study[27].

a. Assessment of Measurement Model

The assessment of a reflective measurement model in this investigation was executed through a four-pronged approach. This encompassed the measurement of indicator loadings, an evaluation of internal consistency reliability via Composite Reliability (CR), the assessment of convergent validity by calculating the Average Variance Extracted (AVE), and the demonstration of discriminant validity through the application of the Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (HTMT) values. This meticulously tailored methodology [34] was rigorously adhered to in this research.In the presented results in Table 1, several crucial statistical metrics have been assessed to gauge the reliability and validity of the constructs within the research model and to understand the extent to which these constructs explain variance in the dependent variable, Safety Performance. First, Cronbach's Alpha, a measure of internal consistency reliability, was applied to research’s constructs. It yielded high values for Safety Compliance (0.923), Safety Participation (0.899), and Safety Performance (0.933), indicating strong internal consistency among the respective items measuring these constructs [28]. Additionally, Composite Reliability, another measure of construct reliability, supported these findings, further affirming the strong reliability of Safety Compliance , Safety Participation, and Safety Performance.

Convergent validity, as measured by Average Variance Extracted (AVE), was also assessed. Safety Compliance demonstrated good convergent validity with an AVE of 0.867, as did Safety Participation with an AVE of 0.831, and Safety Performance with an AVE of 0.832. These AVE values surpassed the recommended threshold of 0.50, indicating that the constructs adequately captured variance relative to measurement error and supporting their convergent validity [27], [29].

Lastly, the R Square (R^2) value for Safety Performance was determined to be 0.425. This value represents the proportion of variance in Safety Performance explained by the independent variables, Safety Compliance and Safety Participation. The model suggests that these two constructs together account for 42.5% of the variance in Safety Performance [30]. These comprehensive findings collectively endorse the reliability and validity of the research model and provide robust support for the efficacy of Safety Compliance and Safety Participation in explaining a significant portion of the variance in Safety Performance, laying the groundwork for further hypothesis testing and analysis in this study.

Table 2. Results of Measurement Model (Convergent Validity)

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	R Square
Safety Compliance	0.923	0.951	0.867	0.425

Safety Participation	0.899	0.937	0.831
Safety Performance	0.933	0.952	0.832

For discriminant validity, this research utilized the most prominent assessment namely Heterotrait-Monotrait ratio (HTMT).The Heterotrait-Monotrait ratio (HTMT) is a more recent method for assessing discriminant validity. The HTMT is a ratio of the between-trait correlations to the within-trait correlations. Values less than 0.85 generally indicate adequate discriminant validity. An HTMT value closer to 1 suggests a lack of discriminant validity between constructs [38], [34].The discriminant validity of the constructs in the research model was evaluated using the Heterotrait-Monotrait (HTMT) ratio [31]. The results, as presented in Table 3, indicate the strength of discrimination between the constructs.

The HTMT ratios between Safety Compliance and Safety Participation, Safety Compliance and Safety Performance, and Safety Participation and Safety Performance were calculated to be 0.732, 0.654, and 0.631, respectively. These values are all below the commonly recommended threshold of 0.85, signifying that the constructs exhibit adequate discriminant validity [27].

In essence, the HTMT ratio analysis confirms that the constructs—Safety Compliance, Safety Participation, and Safety Performance—can be considered distinct from each other, and their shared variances do not overshadow their individual characteristics. This assessment further strengthens the credibility of this research model and provides assurance that the constructs indeed represent separate and unique dimensions within the study.

Table 3. Results of HTMT

	Safety Compliance	Safety Participation	Safety Performance
Safety Compliance			
Safety Participation	0.732		
Safety Performance	0.654	0.631	

b. Assessment of Structural Model (Hypothesis Testing)

In the structural model assessment, bootstrapping with 1000 resampled iterations played a pivotal role in hypotheses testing. This statistical technique provided a robust means to evaluate the relationships between variables. By repeatedly resampling the data and estimating the structural model, we generated a distribution of parameter estimates, facilitating the calculation of p-values and confidence intervals. These outcomes were essential for determining the statistical significance of hypothesized relationships and assessing the model's fit. Importantly, bootstrapping accommodated potential deviations from normality in the data, contributing to the rigor and credibility of the research findings[27], [32]. Table 4 depicted the path coefficients results.

Table 4. Path Co-efficient

	β	**T Statistics**	**Results**
Safety Compliance -> Safety Performance	0.404	3.913*	**Supported**
Safety Participation -> Safety Performance	0.308	3.009*	**Supported**

*significant at p<0.05

The structural model assessment, as presented in Table 3 and Figure 2, provides valuable insights into the relationships between the key constructs. Specifically, we examined the path coefficients and their associated statistical significance to determine the impact of Safety Compliance and Safety Participation on Safety Performance.

The path coefficient from Safety Compliance to Safety Performance was found to be 0.404, with a T statistic of 3.913. This result signifies a statistically significant and positive relationship between Safety Compliance and Safety Performance. In practical terms, it suggests that an increase in Safety Compliance is associated with a corresponding improvement in Safety Performance.

Similarly, the path coefficient from Safety Participation to Safety Performance yielded a value of 0.308, with a T statistic of 3.009. This outcome also demonstrates a statistically significant and positive relationship between Safety Participation and Safety Performance. In essence, higher levels of Safety Participation are associated with enhanced Safety Performance within the organization.

Notably, both relationships were found to be statistically significant at the $P<0.05$ level, underscoring their importance in present research model. These findings also provide empirical support for research hypotheses, indicating that both Safety Compliance and Safety Participation play pivotal roles in shaping and improving Safety Performance.

The results of this study shed light on the critical role of safety behaviour in shaping safety performance within the context of small and medium enterprises (SMEs) in Malaysia.

Firstly, the high internal consistency and strong reliability of the constructs, Safety Compliance and Safety Participation, reaffirmed their robustness as reliable measures of safety behaviour [9], [22], [33]. The convergence of these constructs with theoretical expectations and prior research further emphasized their validity in assessing safety-related activities in the workplace .

Secondly, the structural model analysis revealed significant positive relationships between safety behaviour (Safety Compliance and Safety Participation) and safety performance. The path coefficients, along with their associated statistical significance, confirmed that improved safety behaviour is linked to enhanced safety outcomes, encompassing accident rates, injuries, and incidents related to property damage and goods loss [34]. These findings underscore the significance of fostering a safety-conscious culture within SMEs, where employees not only comply with safety protocols but actively engage in safety-related activities.

Furthermore, this study contributes to the existing literature by emphasizing the multifaceted nature of safety behaviour. Safety Compliance and Safety Participation were found to be distinct yet complementary dimensions, each making a unique contribution to safety performance. Organizations should recognize the importance of addressing both compliance and participation aspects to comprehensively enhance workplace safety.

In the context of Malaysia, the research outcomes unequivocally underscore the palpable and consequential impact of safety behavior variables, namely safety compliance and safety participation, on the improvement of safety performance, gauged through parameters such as accidents, injuries, and property damages. These results resoundingly validate the research hypotheses.

By providing empirical evidence within the Malaysian context, the findings contribute to the broader discourse on SME safety performance, enhancing the generalizability of the study's conclusions. They shed light on the common challenges faced by SMEs globally, emphasizing the universal importance of cultivating safety behavior among employees. This study underscores the pivotal significance of such efforts, particularly in resource-constrained SME settings, as an imperative step toward enhancing workplace safety.

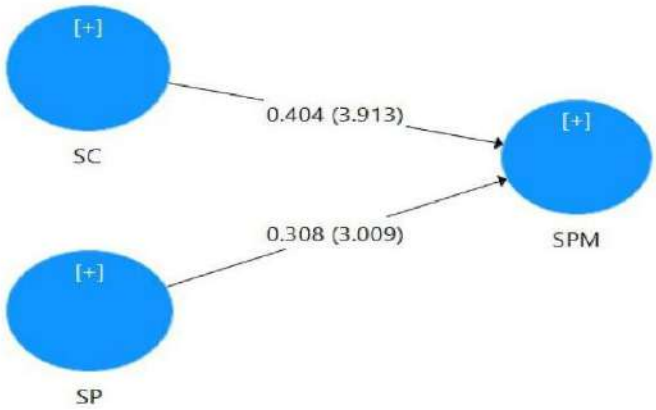

Figure 2. Structural Model

V. CONCLUSION

In conclusion, this study provides valuable insights into the relationship between safety behaviour and safety performance within SMEs in Malaysia. The findings highlight the critical role played by Safety Compliance and Safety Participation in promoting positive safety outcomes. Addressing these dimensions can help organisations mitigate accidents, injuries, and incidents while fostering a culture of safety awareness.

The practical significance of this research is evident for SMEs seeking to enhance workplace safety. Recognising the distinct yet interconnected nature of safety behaviour dimensions allows organisations to tailor safety management strategies effectively to address compliance and participation aspects. These initiatives can result in safer work environments, reduced operational costs, and improved overall organisational performance.

Moreover, the study underscores the importance of ongoing research in occupational safety, particularly within the SME context. Future investigations can explore the mechanisms through which safety behaviour influences safety performance and develop interventions that facilitate sustainable improvements in workplace safety.

This study has limitations. Firstly, the reliance on self-reported data from Safety and Health/Human Resource professionals may introduce response bias and social desirability effects, potentially affecting result accuracy. Additionally, the focus on the northern region of Malaysia limits generalizability to other areas or industries. The cross-sectional data prevents establishing causal relationships over time, suggesting the need for future longitudinal studies. While SmartPLS 3.2.9 offers advanced statistical techniques, alternative methodologies could offer additional insights. Future research could explore mixed-methods approaches combining quantitative surveys with qualitative interviews, or experimental designs to assess specific safety behavior interventions' effectiveness. Furthermore, participatory action research (PAR) could empower SME employees to co-develop and evaluate safety initiatives collaboratively, fostering sustainability and impactful outcomes for workplace safety improvement.

In summary, this research contributes to enriching the understanding of safety behaviour and its impact on safety performance, providing valuable insights for academia and industry. As organisations increasingly prioritise safety in their operations, these findings contribute to fostering safer and more productive workplaces.

VI. ACKNOWLEDGEMENTS

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