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Investigating the role of safety practices in improving safety performance: a case of Malaysian manufacturing company

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ABSTRACT

Past studies exhibited limited published evidence, specifically on examining the determinants of safety performance among employees based on the Heinrich Domino Theory. Thus, this study aimed to assess the role of three prominent variables in explaining the safety performance of employees in manufacturing settings. This study utilized partial least squares structural equation modeling (PLS-SEM) to ascertain the causal effect between the variables and whether the incorporated variables could improve these relationships. The results were based on a survey of employees (N = 150) at TAMCO Switchgear (M) Pte. Ltd., a manufacturing company in Malaysia. The findings suggested that all three variables have a positive and significant direct effect on employee safety performance. These results suggest that organizations, specifically manufacturing companies should consider proper safety management, provide specific safety training, and disseminate safety communication through proper channels to encourage employees to practice proper safety performance at the workplace.

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1.0 INTRODUCTION

Safety performance entails evaluating safety protocols and procedures to assess their effectiveness which includes assessing risk levels, pinpointing potential hazards, reviewing safety policies and regulations, and conducting accident investigations (Paredes, 2024). The goal is to minimize accidents and incidents, enhance the working environment for employees, boost efficiency and productivity, and conserve time, energy, and resources by scrutinizing existing systems, diagnosing safety problems, and proposing solutions.

The Occupational Safety and Health Act 1994, also known as Act 514, establishes the legal framework for ensuring high safety and health standards in the workplace. This act emphasizes the shared responsibility between employers and employees in maintaining a safe work environment. Employers are tasked with creating a hazard-free workplace, while employees are expected to operate within these safe conditions (Mohamed et al., 2022). The Act promotes a self-regulatory approach, requiring employers to set up effective safety organizations and implement performance measures tailored to their specific industry or organization (Nilsen et al., 2016). Furthermore, the Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000 (USECHH 2000) under OSHA 1994 provides a legal structure for controlling the exposure of hazardous chemicals in the workplace (Mohamed et al., 2022). This regulation plays a crucial role in ensuring that workplaces adhere to safety standards regarding the handling of chemicals that may pose health risks to employees. Studies have shown that workplace accidents, particularly in manufacturing sectors, are often caused by human errors, lack of adherence to safety standards, imprecise work methods, changes in the work environment, and inadequate use of Personal Protective Equipment (PPE) (Yudhana, 2017). This highlights the importance of strict compliance with Occupational Safety and Health Environment (HSE) regulations to prevent accidents and promote a safe working environment. The establishment of Occupational Safety and Health Committees (OSHC) in workplaces with 40 or more employees, as mandated by the OSHA 1994, is crucial for ensuring proactive safety measures and fostering a culture of safety within organizations (Farouk et al., 2011). These committees play a vital role in promoting occupational safety and health practices, and addressing safety concerns in the workplace.

Malaysia has reported a significant rise in occupational injuries, with a 58.9 percent increase to 34,216 cases in 2022 from 21,534 in 2021 (Naz Harun, 2023). Consequently, the number of occupational injuries per 1,000 workers climbed to 2.22 from 1.43 the previous year. Non-fatal occupational injuries also surged, with 33,899 cases in 2022, marking a 59.7 percent rise from 21,233 cases in 2021. Therefore, the rate of non-fatal injuries per 1,000 workers increased to 2.20 in 2022 from 1.41 in 2021. Additionally, there were 317 fatal occupational injuries in 2022, an increase of 16 from 301 fatalities in the prior year. This resulted in a higher fatal injury rate per 100,000 workers at 2.06 in 2022 compared to 2.00 in 2021. Employers are required to identify workplace hazards, conduct risk assessments, and implement adequate risk controls before employees begin work (DOSM, 2023).

The manufacturing sector in Malaysia is a crucial and rapidly growing industry. Workers in this sector commonly faced issues such as insufficient emphasis on safety, a high number of occupational accidents due to a lack of safety culture, and non-compliance with the Occupational Safety and Health Act 1994. According to DOSH, occupational Noise-Induced Hearing Loss has increased by 83.7%, occupational musculoskeletal diseases by 4.4%, and occupational lung diseases by 2.3% (Rahlin et al., 2018; Halim et al., 2020). In addition, DOSH records over the past five years show an average increase in fatal accidents by 26%, permanent disabilities by 71%, and non-permanent disabilities by 64%, specifically within the manufacturing sector.

In the context of this study, the safety department at TAMCO Switchgear (M) Pte. Ltd. aimed for zero incidents in the first six months of 2023, based on safety training provided to employees. Based on the

interview with the Head of Safety Manager, as part of the initiatives, TAMCO Switchgear (M) Pte. Ltd. will ensure the use of the latest safety equipment in line with safety standards to achieve this goal. The safety department also targets no incidents involving major injuries or hospitalization for workers in 2023. They emphasize that the safety level for 2023 should be lower than that for 2022, considering that manufacturing employees frequently interact with potentially hazardous machinery, materials, and substances, which are integral to their job and can cause serious injuries, illnesses, and fatalities.

Nevertheless, in 2023, TAMCO Switchgear (M) Pte. Ltd. saw a decline in safety performance among its employees, with 38 incidents reported. This increase included several serious injuries requiring hospitalization for several weeks. Despite holding daily safety meetings to ensure all safety measures were in place before work, TAMCO Switchgear (M) Pte. Ltd. still experienced numerous incidents, underscoring the need for improved safety practices. A major incident occurred when workers disregarded safety tooling for lifting panels, resulting in a worker's severe hand injury and extended hospitalization. Although managers had been briefed about this special tooling, no action was taken. This incident led to significant problems and substantial costs for the company.

Given the above discussion, implementing a transparent module for safety procedures that workers must follow to ensure safe operations is crucial. Workplace safety significantly influences safety performance. Additionally, the effectiveness of interventions like the Occupational Hazard Self-Evaluation Module (OHSEM) in enhancing safety knowledge, attitudes, and behavior among workers in the manufacturing sector has been empirically supported (Zulkifly, 2023). Thus, this study employed a framework adapted from a study by Kassim et al. (2021) to help the safety department at TAMCO Switchgear (M) Pte. Ltd. achieve zero incidents in the first three months of 2024. It aims to identify the factors necessary to enhance safety performance, assuming that safety communication, safety management, and safety training will lead to improved safety performance levels at TAMCO Switchgear (M) Pte. Ltd. This study also aims to address the critical gap in workplace safety within Malaysia's manufacturing sector, which continues to face significant challenges despite existing regulations and safety measures.

2.0 LITERATURE REVIEW

2.1 Overview of Safety Performance

Safety performance is a critical aspect of organizational functioning, encompassing safety-related events and safety behavior. Poor safety performance leads to adverse events and injuries and imposes a financial burden and collateral damage on the organization and its employees (Ajmal et al., 2022). Scholars have developed and tested models that link organizational and individual factors to safety performance, expanding their focus beyond individual flaws to include team members, leaders, and the broader organization, such as workplace communications, safety equipment, and safety management. The existing literature, such as the safety performance framework proposed by Neal and Griffin, divides "safety behavior" into "safety participation" and "safety compliance," but it overlooks the potential impact of safety participation on behavioral compliance (Wang et al., 2021). Furthermore, organizational factors play a crucial role in ethical decision-making, suggesting the co-existence of personal and organizational factors in ethical behavior (Roszkowska & Melé, 2020). Moreover, organizational errors have been mentioned to demonstrate the relationship between accidents and organizational factors, emphasizing the significance of organizational processes in safety outcomes.

Safety performance in organizational settings is a critical aspect of ensuring employees' well-being and the organization's overall success. It encompasses organizations' efforts to minimize accidents and injuries to workers (Otitolaiye et al., 2021). Safety performance is often measured by tangible events such as the frequency of injuries, accidents, or near-misses. It is also closely linked to safety compliance, safety participation, safety behavior, safety culture, and safety climate within an organization (Griffin & Neal, 2000; Saleem et al., 2021; Atikasari et al., 2022). Safety performance management is at the core of the

safety management system in any organization, reflecting the organization's commitment to safety and health, ultimately leading to improved safety performance (Che Mat et al., 2021). Additionally, safety performance improvements in an organization can increase its resistance or robustness and lower the risk of accidents (Razali, 2018).

The concept of safety performance is multifaceted and is influenced by various organizational factors. For instance, safety leadership, attitudes, and knowledge have been found to impact safety-related behaviors, influencing safety performance (Basahel, 2021). Furthermore, compliance with safety measures has been highlighted as a critical factor in reducing accidents in the construction industry, emphasizing the direct relationship between safety measures compliance and safety performance (Al-Kasasbeh et al., 2022). Moreover, organizational commitment to safety and creating a positive safety atmosphere has been shown to impact safety performance positively (Li et al., 2020). It is evident that many organizational and individual factors influence safety performance, and understanding these relationships is essential for enhancing safety outcomes. Effective communication is pivotal in influencing safety performance within organizational settings (Griffin & Neal 2000). For instance, in the construction industry, the importance of informal safety communication among workers has been highlighted, emphasizing the role of communication in promoting safety on construction sites. The significance of communication in construction safety has also been emphasized, with communication being essential for promoting safety in construction work environments (Allison and Kaminsky, 2017).

In conclusion, a wide array of organizational, individual, and contextual factors influences safety performance as a dependent variable. The interplay between communication, safety management, and safety equipment is crucial for understanding its impact and ensuring the effectiveness of safety management systems.

2.2 Factors Influencing Safety Performance

2.2.1 Safety Communication

The role of effective safety communication in enhancing safety performance in manufacturing environments is well-supported by existing literature. The significance of management commitment and safety climate perceptions in influencing safety behavior highlights the importance of clear and consistent communication in disseminating safety protocols and preventing accidents. Additionally, Naji et al. (2022) underscore the mediating role of safety communication between safety culture and employee safety performance, drawing on Social Exchange Theory to emphasize the impact of safety communication on overall safety outcomes (Naji et al., 2022). Furthermore, the study investigates the direct and indirect effects of work characteristics, including communication quality, on self-reported safe working in a longitudinal study of frontline manufacturing employees, further supporting the critical role of communication in ensuring safety in manufacturing settings. Effective safety communication is imperative to foster a safety culture within a manufacturing organization. For instance, the assessment of safety culture maturity in the food industry highlights the importance of communication in maintaining a mature safety culture within the manufacturing sector (Saleem & Malik, 2022). The role of communication and management support in lean manufacturing implementation emphasizes the significance of effective communication in driving organizational initiatives (Zulkifly et al., 2024).

Effective communication in emergencies has been widely recognized in the literature, emphasizing the significance of community resilience and disaster readiness and highlighting the role of communication in coordinating responses during emergencies. Similarly, early-stage risk communication and community engagement strategies emphasize the need for timely and effective communication measures during crises (Zhang et al., 2021). The importance of information technology-enabled disaster response in healthcare underscores the critical role of communication in coordinating emergency responses and ensuring swift and efficient actions during crises (Tavakoli et al., 2023). Past studies collectively underscore the critical role

of communication in promoting a safety culture within manufacturing organizations and ensuring adherence to safety regulations and standards. Thus, this study posited a hypothesis as stated below:

H1: Safety communication positively and significantly influences the safety performance of a manufacturing company in Malaysia.

2.2.2 Safety Management

Management safety practices and programs directly influence job safety and employee commitment, signaling organizational support for employee protection (Ismail, 2020). Safety management in the manufacturing industry is crucial for mitigating risks and ensuring workplace safety. A strong safety culture, fostered by management commitment and employee involvement, is essential to comply with legal requirements and enhance overall productivity and quality. Developing and validating safety climate scales specific to the manufacturing industry is important for understanding the unique nature of safety climate and context culture, which influences employee safety behaviors (Khauthar & Jamian

, 2020). Comparative studies across different industries, such as shipping and manufacturing, provide insights into the specific health and safety practices relevant to the manufacturing sector (Zulkifly et al., 2024). Adequate safety and health management systems boost workers' morale and confidence in the organization's management (Zhang et al., 2021).

The impact of safety management on safety performance in the manufacturing industry is significant and multifaceted. Implementing robust safety management systems is essential for minimizing risks and preventing accidents in an environment characterized by heavy machinery, hazardous materials, and complex operational processes. Effective safety management encompasses risk assessment, implementation of safety protocols, regular employee training, and adherence to legal and regulatory standards (Zulkifly et al., 2024; Taufek et al., 2016). A strong safety culture, supported by management commitment and active employee participation, further reinforces this impact. As employees become more aware and engaged in safety practices, the likelihood of accidents and injuries diminishes, leading to improved safety performance. Moreover, a safe working environment enhances employee morale and retention, reducing accidents and downtime costs. Therefore, effective safety management is not just a compliance issue but a strategic factor that significantly influences manufacturing operations' safety performance and overall success (Çakit et al., 2019; Amirah et al., 2013).

H2: Safety management positively and significantly influences the safety performance of a manufacturing company in Malaysia.

2.2.3 Safety Training

Organizing site safety meetings, periodically educating employees on the usage of safety equipment, and adhering to safety standards are all examples of safety training. Safety training plays a crucial role in enhancing safety performance in the manufacturing industry. Studies by Moosa et al. (2022) have shown a positive correlation between safety training and safety performance. Safety training is considered the most significant safety management activity, as it can predict safety knowledge, motivation, compliance, and participation. Effective safety training is essential for the success of any business, accident prevention plan, or occupational safety and health plan. It not only improves employees' behavior, knowledge, and attitudes towards safety but also contributes to better safety-related outcomes in businesses. Moreover, comprehensive safety measures such as planning safety training for recruits, mentoring programs, assistance for new hires, and enhancements to occupational health and safety have been identified as critical components that lead to improved safety performance in the industrial sector. Employee competency is highlighted as a vital aspect of creating a safe working environment, and the available data suggest a significant link between safety training and safety performance (Quaigrain et al., 2022; Ratnasingam et al., 2010).

Safety training stands out as the most significant safety management activity, with the ability to predict safety knowledge, motivation, compliance, and participation. Effective safety training is crucial for the success of any business, accident prevention plan, or occupational safety and health plan. It not only enhances employees' behavior, knowledge, and attitudes towards safety but also contributes to better safety-related outcomes in businesses. Comprehensive measures such as systematically planning safety training for recruits, implementing mentoring programs, providing assistance for new hires, and improving occupational health and safety practices have been identified as key strategies to enhance safety performance. Employee competency is a critical element in creating a safe industrial environment, and the available data suggests a strong link between safety training and safety performance (Hamdan, 2023; Jaafar et al., 2017; Fernández et al., 2023; Ahmed & Haque, 2023; Syahidah, 2021). Moreover, safety training has been recognized as a crucial factor in reducing worker injuries and fatalities. Research has shown that safety training not only equips employees with the necessary knowledge and skills to identify potential hazards but also influences their safety actions, thereby improving overall safety performance and adherence to safety protocols (Waqar et al., 2023; Milijić et al., 2020; Cao et al., 2021; Cheyne et al., 1999).

H3: Safety training positively and significantly influences the safety performance of a manufacturing company in Malaysia.

3.0 METHODOLOGY

3.1 Participants and Procedure

This cross-sectional study adopted the probability sampling technique which is a simple random sampling. A simple random sampling technique was selected due to the sampling frame in which the list of employees from the operations and assembly departments exists. The respondents hailed from employees involved in the manufacturing process in the TAMCO Switchgear (M) Pte. Ltd. factory. A self-administered Google form survey distributed between March 2024 and June 2024 was used to collect data. The questionnaires were distributed through the employees' immediate supervisors. The sampling size for this study was based on several suggestions. According to the Krejcie and Morgan table, the recommended sample size is 226 based on a population of 580 (total list of employees). However, this study also adhered to the minimum sample size guidelines suggested by Hair et al. (2017), which recommends a minimum of 100 samples for a study with fewer than five constructs, each with more than three items, to effectively conduct data analysis using PLS-SEM. Therefore, this study decided that the sample size and responses to be obtained were around 100 to 226. The primary goal of this study is to collect a comprehensive dataset that includes a wide range of experiences and perspectives from the production department. This sample size of around 100 – 226 people should give enough data for detailed analysis and interpretation. Our study intends to draw significant conclusions about the links between safety performance and essential elements, including management commitment, safety training, and safety communication within the context of the manufacturing business, by using a simple random sampling. In total, 150 valid responses were obtained from the targeted 226 responses (66.3% response rate). The gathered responses were treated as a sampling frame and ran through Statistical Package for the Social Sciences (SPSS) software for data screening and cleaning. There were no missing data or deleted cases removed from the obtained observation.

3.2 Measurements

This study adapted demographic variables of education, age, gender, designation and years of working experience by referring to Md Yusop et al. (2023). The second part of the survey emphasized questions of safety performance, safety communication, safety management and safety training of employees. The 43 items were modified from Haslinda et al. (2016) and Al-Arnous and Abdelwahed (2022). The responses were on a five-point interval scale with answers ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.2 Data Analysis

The SPSS 26 and Smart PLS 3.0 were used to analyze the study model. Harman's single-factor test was used in this investigation to overcome CMV. If the single component contributes to more than 50% of the variation across variables, Harman's single-factor test suggests an issue with CMV. The unrotated component analysis revealed that the first factor accounted for 25.06% of the total variation explained, showing that CMV is not a significant concern in this research.

4.0 RESULTS

4.1 Demographic Profiles

The respondents' demographic profiles are reported in Table 1. This study was conducted at TAMCO Switchgear (Malaysia) Pt. Ltd., which is a switchgear manufacturing company which involves 150 samples that belong to the production workers consisting of Malaysian and foreign workers. Its operation line is dominated by 125 male workers (83.3%) and 25 female workers (16.7%). All the respondents from the operation workers consist of Malaysian 115 respondents (76.7%) and foreign workers 35 respondents (23.3%). 69 respondents were between the ages of 19 and 27 (46%), and 58 were between the ages of 28 and 43 (38.7%). 17 respondents were 44 – 59 years old (11.3%). The smallest number of respondents was 6 workers aged 60 years old and above. Operation workers have a significant role in production; they are skilled and unskilled workers based on their working experience. 45 employees have 5 years and above working experience, which is 30%, 79 (52.7%) employees have less than 5 years working at TAMCO, 26 employees have 1 year and below working years which is 17.3%. For the position of employee, the assembly line consists of 16 employees, 16 engineers (10.7%); in the operation department 16 operators (10.7%), 87 employees from the store department which contributes 58%. For the incident at TAMCO, some workers responded that 137 had never been involved in an incident at TAMCO (91.3%), and 13 respondents were involved in an incident related to the lack of safety procedures and safety awareness.

Table 1. Demographic profiles of the respondents (N=150)

Characteristics	Frequency	Percentage (%)
Gender		
Male	125	83.3
Female	25	16.7
Nationality		
Malaysian	115	76.7
Foreigner	35	23.3
Age		
19 – 27 years	69	46.0
28 – 43 years	58	38.7
44 – 59 years	17	11.3
60 years and above	6	4.0
Years of Working		
5 years and above	45	30.0
Less than 5 years	79	52.7
1 year and below	26	17.3
Position		
Assembly, Engineer, Operator	48	32.1
Storekeeper	87	58.0
Supervisor	6	4.0
Other	9	6.0
Incident		
No	137	91.3
Yes	13	8.7

4.2 Measurement Model

Confirmatory factor analysis (CFA) was used to evaluate the relationships between latent variables and their assigned indicators, as suggested by Ramayah et al. (2018). To validate the CFA for the measurement model (outer model), this study employed metrics recommended by Hair et al. (2017), including convergent validity (measured by loadings and average variance extracted [AVE]), discriminant validity, and composite reliability (CR) for reflective indicators, as reflective constructs were used. As shown in Table 2, almost all item factor loadings exceeded 0.7. Moreover, the AVE values for all items were above 0.5, and all CR values surpassed 0.7. Convergent validity is considered satisfactory when AVE is above 0.5 and CR exceeds 0.6 (Ramayah et al., 2018).

Table 2. Summary of confirmatory factor analysis

Items and Label	Outer Loading	CR	AVE
Safety performance		0.966	0.673
SP1: Safety managers co-operate with each other to solve safety issues	0.772		
SP2: The management often disseminates regulations of safety and health in my factory	0.850		
SP3: My factory establishes regulations of safety and health management	0.809		
SP4: Workplace pathways are neat and tidy in my factory.	0.882		
SP5: Machinery is equipped with good safeguards in my factory.	0.740		
SP6: My factory provides employees with personal protective equipment.	0.835		
SP7: My factory implements the measurement of hazardous environments periodically	0.846		
SP8: My factory establishes safety and health labels in the workplace.	0.851		
SP9: My management carries out self-inspections on employees and the factory.	0.857		
SP10: My factory provides safety and healthy training for employees.	0.835		
SP11: Trainees receive an achievement test at the end of safety and health training in my factory.	0.828		
SP12: I have never been injured in the workplace within the past 12 months.	0.782		
SP13: My factory frequently conducts accident investigations	0.786		
SP14: My factory seriously conducts accident investigations.	0.772		
Safety communication		0.933	0.636
SC1: The factory encourages suggestions for safety and health improvement	0.734		
SC2: There is good feedback from management on reported safety issues.	0.816		
SC3: I can report an accident or near miss without fear of blame or retribution.	0.857		
SC4: Accidents that happen are always reported.	0.838		
SC5: I am given sufficient information on management's decisions regarding safety matters.	0.849		
SC6: Sharing information related to each other is important.	0.810		
SC7: I believe that management has communicated a clear objective regarding safety.	0.770		
SC8: Accident cases are posted on a bulletin board for me and others to know and be aware.	0.792		
Safety management		0.959	0.661
SM1: When there is an accident in my factory, my factory's management knows exactly what to do.	0.856		

SM2: I was given sufficient training on handling accidents at work.	0.87		
SM3: There is a policy in my factory's management accident in my factory.	0.840		
SM4: Management places high priority on safety training to reduce accidents	0.814		
SM5: I was provided with suitable personal protective clothing and equipment for my job	0.818		
SM6: Management is proactive and quick in solving problems related to safety and accidents	0.757		
SM7: Managers show keen interest in workers safety	0.775		
SM8: The communication during accidents is good	0.785		
SM9: When an accident occurs, the management handles the media efficiently	0.821		
SM10: My factory has all the resources to handle accidents	0.845		
SM11: I was well informed on what to do during an accident	0.816		
SM12: My factory's management has way to reduce the occurrence of accidents			
Safety training		0.946	0.688
ST1: The training I attended covered all the safety and health risks associated with the work for which I am responsible.	0.796		
ST2: I have received training on emergency procedures in the workplace.	0.834		
ST3: I have been briefed to identify safety hazards in the workplace.	0.830		
ST4: Safety training on components is included in my orientation program (induction).	0.818		
ST5: I have received specific training in procedures to identify and report safety concerns, adverse events, near misses and errors	0.852		
ST6: I received safety awareness training before being assigned to work on-site	0.830		
ST7: Safety issues are given high priority in training programs	0.856		
ST8: Safety training given to me is adequate to enable me to assess hazards in the workplace. Green practices fit into my work style.	0.818		

Subsequently, the heterotrait-monotrait (HTMT) criterion was assessed to undertake the discriminant validity test. The result in Table 3 shows that all values fulfill the criterion of HTMT <0.90. This indicates that discriminant validity has been ascertained. Besides, the result of HTMT inference also shows that the confidence interval does not show a value of 1 on any of the constructs which also confirms discriminant validity.

Table 3. HTMT criterion

	Safety Communication	Safety Management	Safety Training	Safety Performance
Safety communication				
Safety management	0.854			
Safety training	0.784	0.847		
Safety performance	0.870	0.824	0.807	

4.3 Structural Model

Before the structural model is evaluated, ensuring that no lateral collinearity issue exists in the structural model is crucial. Table 4 presents the results of the lateral collinearity test. The findings demonstrate that all the inner variance inflation factor (VIF) values for all the independent variables requiring multicollinearity examination are lesser than the suggested threshold value of 5.0 ($VIF \leq 5.0$). Hence, no significant levels of collinearity exist among the study's independent variables.

Table 4. Hypotheses testing for direct effect

Hypothesis	Path	β	t-value	p-value	VIF	LL	UL	Decision
H1	SC→SP	0.360	2.562	0.011**	2.039	0.095	0.523	Supported
H2	SM→SP	0.325	3.131	0.002**	2.876	0.104	0.563	Supported
H3	ST→SP	0.295	3.755	0.000**	2.296	0.164	0.490	Supported

*** Significant at 5% $p < 0.05$ (one-tailed)

SP – Safety Performance, SC – Safety Communication, SM – Safety Management, ST – Safety Training

The acceptance of a hypothesis was established on the t-value, p-value, and confidence interval bias corrected based on the hypothesis testing by undertaking a bootstrapping technique with a re-sampling of 5,000. All three hypotheses were supported. Table 4 demonstrates that all three relationships have a t-value ≥ 2.33 . Thus, the relationships are significant at a 0.01 level of significance. The predictors of safety communication (SC) ($\beta = 0.360^{***}$, $t = 2.562$, $LL = 0.095$, $UL = 0.523$, $p < 0.05$), safety management (SM) ($\beta = 0.325^{***}$, $t = 3.131$, $LL = 0.104$, $UL = 0.563$, $p < 0.05$) and safety training (ST) ($\beta = 0.295^{***}$, $t = 3.755$, $LL = 0.164$, $UL = 0.490$, $p < 0.05$) positively significantly influence safety performance (SP). Thus, H1, H2, H3 were supported. The R^2 value of 0.844 is above the 0.26 value as suggested by Cohen (1988) which indicates a substantial model. All three independent variables explain 84.4% of the variance in safety performance. Figure 1 depicts the path analysis diagram for the structural model analysis.

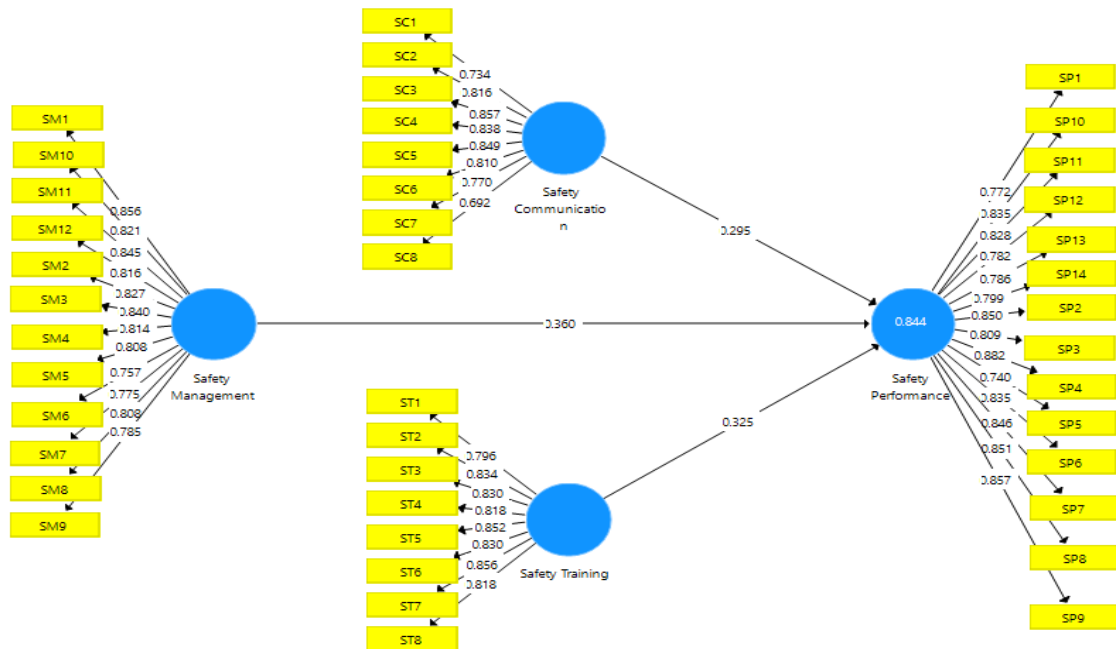


Fig 1. Structural model path diagram

5.0 DISCUSSION

The primary aim of this study was to evaluate the impact of safety communication (SC), safety management (SM), and safety training (ST) on safety performance (SP) within the manufacturing organization. The results from the structural model assessment reveal several critical insights that have important implications for both theory and practice in the field of occupational safety. The result depicted that safety communication, safety management, and safety training directly and positively increase safety performance

by around 80% which implicated the importance for manufacturing organizations to have the three safety practices. First, safety communication emerged as a significant predictor of safety performance, indicating that effective communication channels within the organization play a crucial role in enhancing safety outcomes. This finding aligns with existing literature that underscores the importance of transparent and consistent communication in promoting safety awareness and compliance among employees. Practical implications include the necessity for manufacturing organizations to invest in robust communication systems that ensure timely dissemination of safety information, feedback mechanisms, and regular updates on safety protocols. Theoretically, this supports the view that communication acts as a foundation for building a safety culture within organizations.

Second, the study also found that safety management practices significantly influence safety performance. This suggests that the implementation of comprehensive safety management systems, including risk assessments, safety policies, and continuous monitoring, is essential for improving safety outcomes. From a practical standpoint, this highlights the need for organizations to adopt and rigorously enforce safety management standards such as ISO 45001. Theoretically, this reinforces the notion that systematic management approaches are integral to mitigate workplace hazards and promote a proactive safety culture. Finally, safety training was also identified as a key factor impacting safety performance. The results indicate that regular and effective training programs equip employees with the necessary knowledge and skills to perform their tasks safely, thereby reducing the likelihood of accidents and injuries. Practically, this underscores the importance of continuous education and training initiatives tailored to the specific needs of the workforce. Theoretically, it supports the argument that ongoing training is vital for maintaining high safety standards and adapting to evolving safety challenges within the manufacturing sector.

The integration of these findings highlights the interconnectedness of safety communication, management, and training in shaping safety performance. It suggests that a holistic approach, where these elements are synergistically implemented, can lead to substantial improvements in safety outcomes. For practitioners, this implies the need for an integrated safety strategy that harmonizes communication, management, and training efforts. For researchers, it opens avenues for exploring the interdependencies between these factors and their collective impact on safety performance.

This study addresses the critical gap in workplace safety within Malaysia's manufacturing sector, which continues to face significant challenges despite existing regulations and safety measures. The notable increase in occupational injuries underscores the need for more effective safety strategies. Although initiatives like the Occupational Safety and Health Act 1994 and safety training at TAMCO Switchgear (M) Pte. Ltd. have been implemented, the persistent rise in incidents, including severe injuries, highlights the inadequacy of current measures. This research fills the gap by implementing a transparent safety procedure module and testing the effectiveness of the Occupational Hazard Self-Evaluation Module (OHSEM), thereby providing a framework to enhance safety performance and reduce incidents, injuries, and fatalities in the manufacturing industry.

6.0 PRACTICAL IMPLICATIONS AND RECOMMENDATIONS FOR ASIAN BUSINESS

To enhance safety culture and engagement in manufacturing companies, it is imperative to address language barriers. It can be done through the development and implementation of comprehensive safety training and awareness programs targeted at the 30- to 40-year-old demographic. These programs will feature interactive activities, visual aids, and multilingual training sessions, ensuring that all employees in this age group are actively engaged and aware of safety protocols while accommodating their diverse backgrounds and learning styles. In addition, leadership support is vital for increasing middle-level management participation in safety campaigns and ultimately shaping worker attitudes toward safety. Regular safety meetings with middle-level managers will facilitate discussions on current safety concerns and garner valuable input on enhancing worker engagement and safety protocols. These meetings are essential for motivating managers to actively promote a safe workplace and foster a cooperative attitude towards safety. Given that middle-

level managers serve as the link between upper management and front-line staff, their role is critical in the successful implementation of safety initiatives.

It is proven that by establishing an integrated safety management system that adheres to regulatory requirements and industry best practices is another crucial element. This system provides a structured framework for effectively addressing various safety concerns. A thorough assessment of the current safety management system, coupled with the implementation of a new system that integrates safety processes, data monitoring, and continuous improvement mechanisms, will ensure consistent adherence to and monitoring of safety procedures throughout the organization. This consistency is essential for fostering a culture of continual development and maintaining stringent safety standards. Effective communication strategies are also paramount in cultivating a safety culture in all business operations, especially in the manufacturing process. Enhancing safety communication and engagement strategies will ensure that all employees are reached, and their specific safety concerns addressed. Implementing a safety suggestion program, where employees can submit ideas for safety improvements and receive regular feedback on their suggestions, will actively involve employees in the safety improvement process. This approach empowers employees and fosters a sense of shared responsibility for safety, contributing to a workplace culture where everyone feels accountable for maintaining a safe environment.

To further optimize safety practices and capabilities, the companies should provide the latest safety equipment, demonstrating a strong commitment to worker well-being. Upgrading Personal Protective Equipment (PPE) to meet the latest safety standards will enhance employee protection. Collaborating with the Department of Occupational Safety and Health (DOSH) will enable the factory to leverage its expertise and resources in developing and implementing more effective safety campaigns and awareness programs. Inviting DOSH representatives to conduct safety audits and provide recommendations will be instrumental in refining safety initiatives. Organizing knowledge-sharing sessions with the team will facilitate the incorporation of best practices into factory safety procedures.

The strategies for enhancing safety culture and engagement in manufacturing companies can be broadly applied across various industries and regions. However, it should be done with caution. Addressing language barriers through comprehensive, multilingual safety training is not only crucial for manufacturing but also benefits industries such as construction and healthcare, where diverse workforces and clear communication are essential. This approach is especially valuable in developing regions with high proportions of non-native speakers, and it can be adapted for global operations to ensure safety practices are consistent across different locations. Similarly, engaging leadership and middle-level management is vital for fostering a strong safety culture. This principle applies to sectors like retail and hospitality, where middle managers play a key role in implementing and enforcing safety protocols. Adapting leadership strategies to fit different cultural contexts can enhance their effectiveness, and involving local managers in international branches ensures that safety practices are relevant and well communicated. Implementing an integrated safety management system, which adheres to best practices and regulatory requirements, is beneficial across various industries such as transportation and energy. This system helps maintain consistent safety standards and facilitates continuous improvement. On a global scale, a unified safety management system can accommodate local regulations while ensuring overall safety standards are upheld. Finally, enhancing safety communication and providing updated equipment can improve safety outcomes in diverse sectors like logistics and agriculture. Effective communication strategies and modern safety equipment are crucial for managing risks and ensuring a safe working environment. In both developing and developed regions, these practices contribute to a proactive safety culture, ensuring that all employees are engaged and equipped to maintain high safety standards.

It is imperative for manufacturing companies to continuously monitor the regulatory environment to develop a proactive response to changing safety regulations and ensure ongoing safety improvement and adaptation. Designating a dedicated safety compliance officer to regularly evaluate and update safety policies and procedures in line with the latest regulatory changes will help maintain alignment with these

regulations. Investing in continuous safety training and skill development will equip employees to uphold high safety standards even as the work environment evolves. Establishing a comprehensive safety training program that includes opportunities for cross-training, frequent refresher courses, and hands-on demonstrations will keep employees informed of best practices. Additionally, fostering an organizational culture of resilience through safety, adaptation, continuous learning, and a proactive approach to emerging safety issues is essential. Introducing a safety suggestion program that incentivizes employees to identify potential safety hazards and propose innovative solutions will further strengthen the proactive safety management culture. By implementing these comprehensive recommendations, in general, manufacturing companies will be able to enhance their overall safety performance by leveraging their strengths, addressing their weaknesses, seizing opportunities, and mitigating potential threats. These measures will not only improve safety outcomes but also cultivate a more proactive, knowledgeable, and engaged workforce committed to maintaining a safe and healthy work environment.

7.0 CONTRIBUTIONS OF AUTHORS

The authors confirm the equal contribution in each part of this work. All authors reviewed and approved the final version of this work. Hamidah conceptualized the central research idea and provided the theoretical framework, wrote the methodology, data analysis and revised the article. Muhammad Fauzan detailed out the problem statement and helped in data collection at TAMCO Switchgear (M) Pte. Ltd. Mohd Rezza and Zahin Farhana detailed out the literature review part and finalized the recommendation.

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9.0 CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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