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Resilient Safety Culture and Safety Performance: Examining the Effect in Malaysian Paramedic Training Institute through Importance-Performance Map Analysis (IPMA)

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Abstract: An increasing number of studies have shown that safety culture factors have a substantial influence on safety performance in a variety of industrial sectors. These factors' impact on safety performance are unclear, especially at public service and statutory authorities. On the other hand, the understanding of indicators for safety performance in every working sector in Malaysia is continuing to progress. Hence, this study's contribution is to explore the influence of safety culture factors (i.e., management commitment and supervision in safety, safety system) and safety competence on safety performance in government paramedic training institutes. Importance-performance map analysis (IPMA) is a technique used in Smart PLS to determine the significance and performance of each of these factors. The study was conducted via an online survey and involved 258 safety and health committee members in the Ministry of Health paramedic training institute. As a matter of relevance, the IPMA's empirical data study revealed that management commitment and supervision in safety were the predominant factors in determining safety performance. Meanwhile, for performance, the findings showed that worker involvement, safety system, and safety competence perform well in determining safety performance.

Keywords: safety performance; safety culture; resilience culture; paramedic; training institute; IPMA; PLS-SEM

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1. Introduction

Safety performance is defined in literature by two categories of measurement, namely, reactive and proactive measures [1]. For reactive measures, it is the number of accident-free days or safe work records within the organisation. Poor safety performance is the term used when the number of reported incidents is high [2,3]. Proactive measure is used to evaluate the organisation's effort or progress in inculcating safety practices to enhance performance [4]. In this research, safety performance was defined using the proactive measure as an indication assessed before incidents happen, focusing on employees' perceptions of safety culture indicators for the benefits from the organisation practicing safety and health.

Safety culture factors have a proven relationship with safety performance based on the current systematic literature review [5]. The review showed a positive and negative relationship of safety culture to safety performance based on two types of safety performance measurement (reactive and proactive) in 46 different studies. The result also showed that varieties of safety culture indicators were evaluated and chosen based on industries or working sectors. For instance, a study that investigated the effect of safety culture indicators (i.e., management commitment, safety communication, and adequacy of resources) on the safety performance in an explosive defence ordinance showed a positive association. Furthermore, a study conducted in manufacturing plants in Denmark [6] examined the effect of a supervisor's safety leadership, safety instructions, and safety performance. The findings pointed out that safety performance in terms of accident rate among production workers is positively affected by all the studied safety culture factors. On the other hand, some studies reported that certain safety culture indicators demonstrated a negative relationship with safety performance, such as return to work, postinjury administration, supervisor performance feedback, and coworker support [7,8].

Different organisations have different sets of resilient safety culture indicators [5,6] that improve safety performance. In Malaysia, research has been conducted and proved this relationship. Research conducted in the manufacturing sector of electric and electronics in Malaysia indicated that all dimensions of safety climate studied, such as safety commitment and action from top management, managers, and employees, perceived risk, and emergency response were important predictors and showed a significant relationship to safety performance [9]. Another study performed in the Malaysian industrial zone also concluded that a strong safety culture combined with appropriate management practices is crucial to effectively reduce workplace injuries. As a result, companies will see a reduction in missed work hours and accident-related compensation costs, resulting in financial gains. Reduced injuries may also enhance employee engagement, productivity, and product quality while decreasing employee turnover [10].

Indeed, many studies in the high-risk sectors, such as construction, manufacturing, and radiation facilities, have shown the major influence of safety culture on safety performance and that it can be improved [11–13]. What remains ambiguous is the influence of these factors on safety performance in government agencies, especially for the paramedic training institute that record high numbers of work-related incidents every year. Based on the annual report from the Department of Occupational Safety and Health between 2017 and 2020, there was an increasing trend in reported workplace accident cases of 64%, from 47 cases to 77 cases in the last year. Low safety performance is reflected with many adverse impacts such as a high frequency of occupational incidents, road traffic accidents, and trips and falls. A paramedic training institute under the Ministry of Health Malaysia recorded 17 inhouse incidents that caused absenteeism, reduced staff confidence to perform work productively, and negatively impacted the quality of life of the workers. In addition to reactive measurement of safety performance in literature through observing the incident number, it was also studied with a proactive measure for the organisation under public services and statutory authorities [14–19]. Although past studies have been conducted among healthcare professionals, none was concerned with the training sector and explored additional safety competence factors included in this study. Hence, this study contributes to a new theoretical gap by investigating the impact of safety culture factors on safety performance at a government paramedic training institute and determining the importance and performance values of each studied factor.

2. Hypotheses Development

Five safety culture factors that are deemed to impact safety performance in paramedic training institutes (i.e., safety system, safety risk management, and worker involvement in safety) were presented in the research model depicted in Figure 1 below. The following subsections go through each factor's description as well as the hypotheses that have been established.

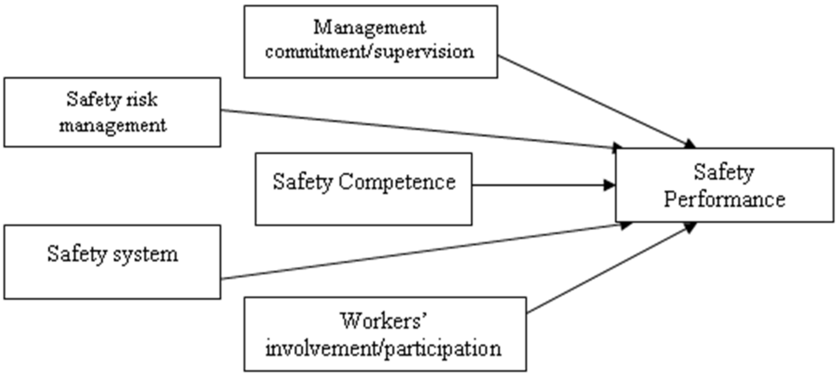

Figure 1. Safety performance model based on safety culture factors.

2.1. Management Commitment or Supervision (MC)

Management commitment or supervision refers to the safety culture of upper management, the tangible practices, responsibility, and performance related to health and safety that includes the association between safety management, climate, and culture [20]. Significant impact of this safety culture factor, the management commitment, or management supervision in safety to the improvement of safety performance has been reported in literature [21–23]. Therefore, the first hypothesis is as follows:

H1. *Management commitment or supervision in safety has a significant impact on safety performance.*

2.2. Safety Risk Management (RM)

Safety risk management refers to a process on how to communicate, consult, set up a framework for risk assessment and evaluation, and monitor and review safety risks using management rules and procedures [24]. The significant impact of this safety culture factor, the safety risk management to the improvement of safety performance, has been reported in literature [25–28]. Thus, the second hypothesis is as follows:

H2. *Safety risk management has a significant positive impact on safety performance.*

2.3. Safety System (SS)

Safety system is described as how the system functions in practice, identifying areas where corrective action is necessary, and giving feedback and encouragement [29]. The significant impact of this safety culture factor, the safety system to the improvement of safety performance, has been reported in literature [30–32]. Hence, the third hypothesis is as follows:

H3. *The safety system has a significant positive impact on safety performance.*

2.4. Workers' Involvement or Participation in Safety (WI)

Workers' involvement or participation in safety refers to a proactive step in the safety power format by including the bottom level (i.e., workers) at the earliest brainstorming stage of initiating a change or any intervention in safety. This also included allowing a worker's point of view in any safety-related matter at the workplace [33]. Prior research pointed out the significant relationship between the workers' involvement in safety and safety performance [34–36]. Accordingly, the fourth hypothesis is as follows:

H4. *Workers' involvement or participation in safety has a significant positive impact on safety performance.*

2.5. Safety Competence (SC)

Safety competence refers to a collection of knowledge, skills, and related continuing education, as well as the capacity to solve problems, think critically, and predict variables that may have an influence on the outcome. It is claimed that a competent individual is one who is able to detect, analyse, and act on near misses and possible bad occurrences. Incompetence can lead to failures that have significant implications for the safety of others [37]. The significant impact of this safety culture factor, the safety competence to the improvement of safety performance, has been reported in literature [36,38,39]. Hence, the fifth hypothesis is as follows:

H5. *Safety competence has a significant impact on safety performance.*

3. Methodology

3.1. Respondent

The sample of this study involved the safety and health committee members in the paramedic training institute. Stratified random sampling was used to determine the number of samples by dividing the study population (N = 330) into subpopulations based on the number of safety and health committee members. Using the G*Power tool, a total of 250 safety and health committee members from five zones of the paramedic training institute were required to participate in the study according to the percentage of members in each zone. The respondents were contacted through emails and WhatsApp, and they took part by answering the questionnaire through the survey link. A total of 258 respondents successfully completed the online survey. Respondents included in this study were those who fulfilled criteria as: (1) a safety person in charge for each institute; (2) a member of their institute's safety and health committee; or (3) having had formal health and safety training/education. It was also expected that the respondents are familiar with safety processes and would provide accurate comments [20,40].

3.2. Instrument

The questionnaire is divided into three sections. Section A describes the background and sociodemographic information, such as job title, years of work experience, age, gender, incidence data in the institutes they are working in, and incidence types. Section B relates to the institute's existing safety and health culture practice based on their perception. Section C comprises questions related to perceptions of how safety and health culture practice might improve safety performance in the institute. All indicators were developed based on a comprehensive literature review [15–19,41–46]. The data collection for the questionnaire took four months, from January 2021 to April 2021. In total, Google Form links to the questionnaires were sent out via email and WhatsApp medium to the Ministry of Health training institute respondents and 258 form responses were received after the due date.

3.3. Data Analysis

SmartPLS version 3.3.3 [47] was used to analyse the proposed exploratory research model. It was used in accordance with its general principles and techniques [48]. The analysis involved the measurement model and structural model assessment. This was indicated in previous studies [49]. However, in this study, only two analyses; the measurement model evaluation and the importance-performance map analysis (IPMA) were focused on.

3.4. Ethical Consideration

After the identification of potential respondents, they were contacted by phone for consent and email to confirm their suitability and ability to engage in the research study. All respondents gave their informed consent for inclusion before participating in the study. Institutional approval to conduct the study was obtained from the selected Ministry of

Health training institute's director. All the information obtained from this study will be kept confidential, and only summarised data will be presented in reports or publications.

4. Results

4.1. Measurement Model Analysis

During the assessment of a measurement model, both reliability and validity must be evaluated, according to the literature [49]. Cronbach's alpha and composite reliability (CR) typically represent the reliability and should both be equal to or greater than 0.70 [49]. As a result, the reliability measures have been confirmed, as shown below.

Both convergent validity and discriminant validity must be determined in order to establish validity [49]. The indicator loadings and average variance extracted (AVE) are the two values that must be evaluated to determine convergent validity. The values should be equal to or larger than 0.706 and be equal to or more than 0.50, respectively, in order to comply with the accepted threshold values [50]. Table 1 shows that the values for both are within the acceptable range; thus, the convergent validity has been established. To determine the discriminant validity, the heterotrait-monotrait ratio (HTMT) of correlations should be established [51] with a value of less than 0.90 [52]. From the result, it was observed that the HTMT values were good, according to the readings in Table 2, confirming the discriminant validity.

Table 1. Measurement model analysis result.

Item	Loadings	Composite Reliability (>0.708)	Average Variance Extracted (>0.5)
SC1	0.833	0.884	0.717
SC2	0.869		
SC3	0.838		
MC1	0.710	0.911	0.508
MC2	0.600		
MC3	0.685		
MC4	0.780		
MC5	0.695		
MC6	0.772		
MC7	0.687		
MC8	0.737		
MC9	0.760		
MC10	0.682		
OUT1	0.829	0.911	0.632
OUT2	0.775		
OUT3	0.850		
OUT4	0.643		
OUT5	0.826		
OUT6	0.829		
RM1	0.763	0.813	0.523
RM2	0.779		
RM3	0.615		
RM4	0.725		
SS1	0.797	0.870	0.576
SS2	0.831		
SS3	0.720		
SS4	0.838		
SS5	0.659		
WI1	0.838	0.814	0.598
WI2	0.854		
WI3	0.603		

Table 2. HTMT analysis results.

Construct	MC	SC	SP	RM	SS	WI
MC						
SC	0.789					
SP	0.731	0.782				
RM	0.652	0.498	0.488			
SS	0.659	0.728	0.753	0.578		
WI	0.870	0.872	0.707	0.726	0.581	

Note: MC = management commitment and supervision; SC = safety competence; SP = safety performance; RM = risk management; SS = safety system; WI = workers' involvement in safety.

4.2. IPMA Analysis

IPMA offers advancement in the partial least square-structural equation modelling (PLS-SEM) analysis, which was employed in this study by selecting the safety performance constructs as the target construct. IPMA widens the understanding of PLS-SEM analysis outcomes by involving the average value of the latent constructs and their indicators [53]. The IPMA posits that the total effects show the importance value of the preceding factors in framing the target factor (safety performance), while the average of latent construct values indicates the performance value of those constructs.

The importance and performance value of the four safety culture constructs, such as safety system and safety risk management, as well as the mediator construct, were calculated and depicted in Figure 2 below. The findings pointed out that management commitment and supervision in safety exhibits the highest values on importance measure yet remains at the bottom on the performance measure. Furthermore, safety system and safety competence exhibit the second and third highest values on importance measures. Moreover, safety risk management showed the lowest values of the importance measure.

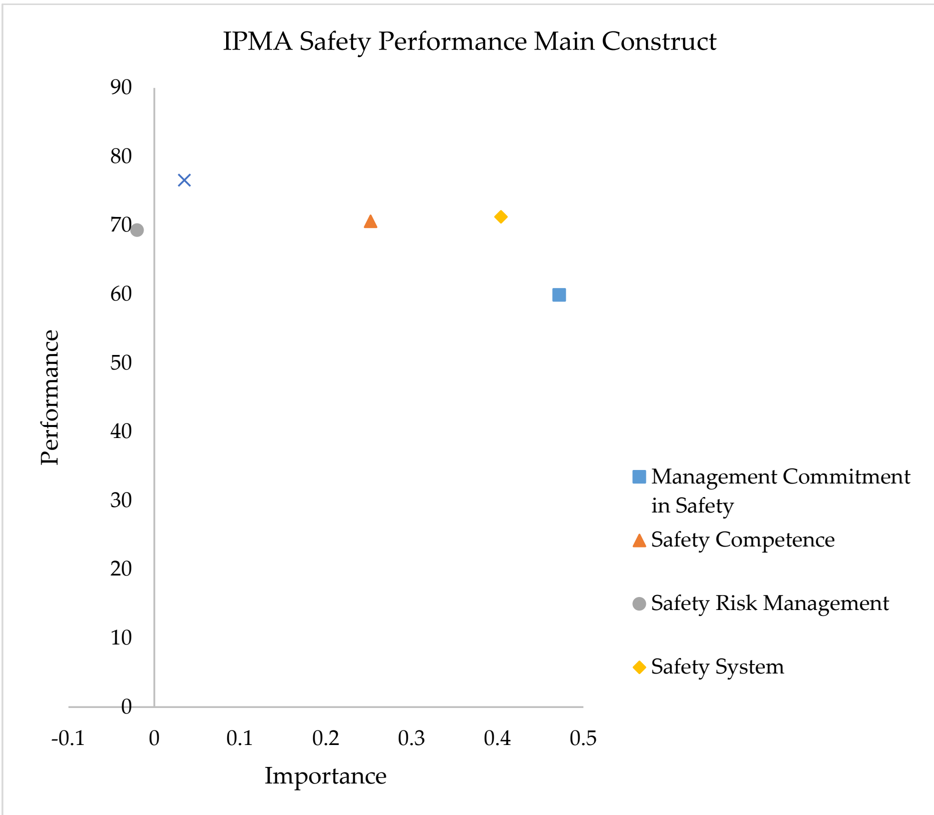

Figure 2. IPMA result based on PLS-SEM analysis in SmartPLS.

5. Discussion

The IPMA analysis in this study showed that management commitment and supervision in safety is the most critical construct to focus on, but is still lacking in implementation by the institute. Based on the IPMA graph (refer to Figure 2), the plot position for the construct illustrated quite an unbalanced level of importance and performance in the developed model. In addition, safety competence and safety system elements also showed a high position on the importance plot in the IPMA graph. Those constructs played a significant role in improving safety performance in the organisation. It is similar to the study by [54] that proved management commitment to safety affects worker injury performance by fostering shared views of their immediate superiors' safety requirements. Supervisors serve as a conduit for communicating corporate safety objectives to front-line employees and offer critical feedback on their conduct's appropriateness [55]. The relationship between safety commitment at the top of the organisation and the incidence of injuries in workgroups was entirely mediated by supervisors' competency in safety. In short, the safety culture dimension studied described the tendency of institutional members and their organisations to produce a perceptual and practical or behavioural impression of their relationships with other institutional members and the workplace environment. Interactions from the social environment help form shared perceptions and adaptive characteristics that control behaviour. The social environment of a workplace that cares about safety and matches that with their abilities shapes their self-competence and readiness to face any hazards and safety issues or risks.

The implementation of this study generally followed the procedure as described in the methodology section. However, there were some limitations of the study that occurred beyond the control of the researchers. The first aspect concerned the study sample. Researchers targeted the required number of samples for each institute, but a small number of respondents did not answer the questionnaire given. This circumstance resulted in the number of samples obtained to be off the target (i.e., invalid responses). However, this issue was overcome because more responses had been gathered to accommodate for the invalid responses.

6. Implication and Conclusions

There are two implications presented based on the study outcomes. Firstly, this study introduced to the body of knowledge, the first attempt to explore the impact of four resilience safety culture factors (i.e., management commitment/supervision in safety, safety system, safety risk management, and worker's involvement in safety) and safety competence on the safety performance in the paramedic training institute. Secondly, this study suggested to the decision makers of the Malaysian paramedic training institutes the idea of the training management division (BPL). The Ministry of Health Malaysia will need to strategise and strengthen the most crucial factor identified with the lowest performance value: management commitment and supervision related to safety matters. This includes developing their policies and planning yearly safety-related programs and training. Besides that, they need to refer to related safety acts and regulations and prepare related safety procedures applicable to paramedic training institutes due to the significant roles this factor plays in affecting safety performance.

Briefly, understanding the feasibility of safety culture indicators for paramedic training institutes and their relationship to safety performance is a fundamental concern that is yet under progress. Indeed, [56] discovered support for applying the social exchange theory to the context of safety climate, demonstrating that management's commitment to workplace safety features is a component of social exchange dynamics, with employees reacting more positively when they perceived greater organisational support for workplace safety. Using IPMA, this study investigated the effect of safety culture factors on safety performance at a Malaysian government paramedic training institute. In terms of importance, the findings exhibited that management commitment and supervision in safety is the prime factor in determining safety performance, followed by safety system and safety competence.

Meanwhile, for performance, the findings showed that workers' involvement in safety performs well in determining the safety performance, followed by safety system, and safety competence, respectively.

For future work, the structural model should be presented to provide better insights into the impact of safety culture factors and safety competence on safety performance in the government paramedic training institute.

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Institutional Review Board Statement: The study was conducted following the Declaration of Helsinki, and the protocol was approved by Research Ethics Committee of UiTM (REC/07/2020 (MR/152)) as well as the Medical Research and Ethics Committee of the Ministry of Health (NMRR-20-994-54102 (IIR)).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The article/supplementary material contains the study's original contributions. Additional questions should be addressed to the corresponding author(s).

Conflicts of Interest: The authors declare no conflict of interest.

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