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Safety-Management Practices and the Occurrence of Occupational Accidents: Assessing the Mediating Role of Safety Compliance

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Abstract: This study examines the impact of critical safety-management practices on the occurrence of occupational accidents by means of safety compliance in Malaysia's oil and gas industry. This study employed a cross-sectional design, in which data were collected from oil and gas downstream operations in five states within Malaysia using the convenience-sampling technique. The valid data of 280 responses were analyzed with Smart-PLS, and the structural-equation-modeling technique was applied. The study's outcome revealed that safety-management practices (i.e., safety training, workers' involvement, safety communication and feedback, management commitment to safety, safety-promotion policies, and safety rules and procedures) were significantly associated with occupational accidents via safety compliance. Thus, this study is helpful for practitioners and researchers to understand the importance of safety-management practices in reducing occupational accidents.

Keywords: safety training; safety communication and feedback; safety compliance; safety management; occupational accidents; oil and gas industry; Malaysia

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1. Introduction

Occupational accidents in organizations result in huge damages to employees' lives every year [1]. However, organizations have financial costs to bear in terms of productivity, compensation paid, and workdays lost [2,3]. In addition, they also face the nonfinancial cost of occupational accidents, e.g., the psychological trauma of employee absence from work [4]. In the last two decades, investigations of major industrial accidents pointed out leading factors, e.g., poor safety management [5]. Therefore, attention to occupational accident prevention has been shifted from human and technical errors to catering employees' safety with management practices [6]. In this regard, safety management plays the most significant role in intervening in the caution process of occupational accidents [7].

The investigation of safety-management literature revealed that numerous studies had highlighted the occupational accident issues that high-hazard organizations are facing, i.e., the oil and gas, construction, and manufacturing industries [8,9]. The market's cutthroat competition compels organizations to increase the growth of goods, leading to unsafe production methods and occupational accidents [10,11]. Therefore, in New York in 1913 a meeting was held consisting of safety professionals, insurance specialists, public officials, and management leaders to highlight the problem related to occupational health and safety. Furthermore, one outcome of the meeting was the birth of the "National Safety Council," and later on various organizations were introduced, including the "British Safety Council" and the "International Labor Organization." Moreover, in 1973 in the United States of America (USA), the "Occupational Health and Safety Act" (OSHA) was introduced, and later on, other countries such as Australia and the United Kingdom took similar

steps [12,13]. The results of the above health and safety acts played a most significant role for workers to raise important concerns related to occupational accidents and injuries [14].

Safety management in organizations is more than hazard identification; it includes planning of safety activities, effective implementation, and risk analysis to reduce the chances of occupational accidents [15–17]. Safety activities, safety training, and investigation of workplace accidents and near misses should be assigned at every level to promote safety culture [18]. Previous studies related to safety management have focused on behavioral interventions for reducing human errors and reducing occupational accidents [19,20]. Management focuses on promoting a safety culture to accomplish job performance by complying with safety standards [21]. Therefore, safety compliance is the most important thing; employees should adhere to safety procedures for carrying out work safely [22]. The safety-management literature shows that several studies have shown a most important role of safety compliance in reducing occupational accidents [23,24]. According to Neal and Griffin (2006), safety compliance is one of the core activities that need to be demonstrated to reduce workplace accidents and injuries. The discussion of the above studies shows the significant role of safety compliance with safety management in reducing occupational accidents.

According to the International Labor Organization (ILO), every 15 s around the globe, 153 workers suffer from work-related injuries and accidents, and one worker dies. Moreover, 4% of gross domestic products (GDP) are impeded because of occupational accidents and injuries, and 2.3 million deaths annually occur because of work-related injuries and occupational accidents. Therefore, Malaysia's oil and gas industry plays a most important role in supporting the country's economy and creating employment opportunities. According to the Malaysia Development Bank (MDB), there are three primary players, including PETRONAS (43%), ExxonMobil (16%), and Shell (22%), contributing 14.5% of the country's revenue (MDB-2019). However, reducing the rate of occupational accidents is a challenge for Malaysia's oil and gas industry. Therefore, the current study aims to investigate the impact of safety-management practices on occupational accidents via safety companies in Malaysia's oil and gas industry. In the Malaysian oil and gas sector, previous studies analyzed safety-performance factors; although these factors were important, the effects of safety-management practices via safety compliance were overlooked. This study aims to make up for the lack of empirical research on safety-management practices in the oil and gas industry of Malaysia.

2. Literature Review

2.1. Safety-Management Practices

The systematic activity of safety-driven management to protect employees and control hazards related to health and safety is called safety management [1]. Furthermore, safety management is more than investigating accidents and hazardous identification [25]. Typically, safety management is all about arranging safety training, safety promotion, accident-prevention practices, and the development of safety culture [26].

The actual role of safety management is associated with functions and practices in the organization to remain safe [27]. In addition, safety management is a subsystem of organizational management, maintaining safety via various safety-management practices [28]. The safety-management system in organizations is designed to prevent workers from workplace hazards and to prevent challenges to health and safety [1]. Moreover, safety-management practices include policies, strategies, practices, and procedures implemented to prevent employee injuries and lower the cost of safety [29].

The literature investigation on safety management shows that safety-management practices are essential tools to manage firms' safety and reduce occupational accidents [30]. In addition, safety-management practices should aim to share the safety environment of the workplace [31]. The investigation of safety-management literature shows that top managements of companies need to improve safety performance through effective safety-management practices [9,32,33].

2.2. Safety Training

Safety training is the transfer of safety knowledge in order to perform job tasks safely without experiencing occupational accidents [34]. Safety training is one of the most important practices for enhancing safety performance [35]. In organizations, safety training is conducted by formal and informal training programs [36], and capacity-building programs provide an opportunity for employees to develop behavioral safety and safety skills [37,38]. Occupational training for employees to participate actively in safety programs is most important [39]. Safety training can be performed based on a proper assessment to improve employees' behavioral safety and skills [40]. Proactive safety training plays a significant role in developing employees' safety knowledge and safety skills [41]. Moreover, in the past, many studies have found a considerable impact of safety training on reducing workplace accidents and injuries [41,42].

The investigation of safety-management practices shows that safety training is one of the essential practices influencing safety outcomes in high-safety-sensitive organizations, e.g., the oil and gas, manufacturing, and construction industries. Moreover, the value of safety training is linked to improvement in the behavioral safety of employees and development of safety skills [43]. Furthermore, safety training programs are designed to train new recruits to shape safety attitudes, orientation, and succession-planning programs to improve occupational health and safety performance [44,45]. Numerous studies have found that effective safety training programs begin with training needs assessments, and that organizations with low rates of injuries and accidents have the best safety programs [40,44].

2.3. Worker Involvement

Worker involvement is a behavioral technique that allows workers to become involved in the decision-making process of the organization in order to provide suggestions for safety improvement [46]. It is the involvement of workers in safety-related decision making, comprising safety committees and management consultation with workers about safety matters [47]. It is also considered one of the vital safety-management practices, which plays an important role in reducing occupational injuries and accidents in safety programs [2,46].

The extent of worker involvement is one of the vital safety-management practices, which plays an important role in reducing occupational injuries and accidents in safety programs [48]. Further, it is the extent of worker involvement in occupational health and safety programs to resolve workplace safety-related issues and reduce workplace injuries [49]. In the safety-management process, worker involvement can take the form of upward communication, especially when new technology is introduced in the organization [50]. The investigation of safety literature shows that the involvement of workers in safety activities is also the most important component of safety culture, and helps to achieve safety ownership [51]. In organizational safety management, worker involvement is a fundamental practice that plays a most significant role in achieving the organization's objective related to occupational health and safety [52].

The involvement of workers in the safety-related strategic decisions of an organization can reduce the rate of occupational injuries and accidents [53]. Similarly, to observe the unsafe behavior of workers and rate of occupational accidents, worker involvement was examined [54], and results of the study highlighted that a high involvement of workers in safety activities helps to report safety-improvement suggestions and reduce occupational accidents [55]. Worker involvement is upward communication; therefore, it is a behavioral technique that allows workers to be involved in the decision-making process of the organization to provide suggestions for safety improvement [56]. Furthermore, worker involvement can range from a low to high level of involvement, and finally, workers close to work are the best-qualified to suggest improvements in workplace safety [57,58]; therefore, worker involvement is considered a safety-management practice for the involvement of workers in safety-related decision making, comprising safety committees and the consultation of management with workers about safety matters [59].

2.4. Safety Rules and Procedures

In safety-sensitive organizations, it is usual to prepare safety rules and procedures and enforce them through safety supervisors to in order to maintain safety performance [59,60]. The prior research studies based on the construction field show a significant correlation between safety rules and procedures and occupational accidents [61,62]. In manufacturing and operation departments, safety experts and manufacturers of machinery visit for inspection, and these visits establish the safety rules and procedures for operating machinery in a safe manner [63,64].

In addition, all new machinery should have protective equipment and documented procedures for safe use [65]. In Malaysia, the OHS Act 1994 for Malaysian workers provides a legislative framework for occupational health and safety.

Zohar (2010) pointed out that safety leaders can play an important role in stopping workers performing unsafe acts by giving rewards and punishments. It was also stated that safety is the responsibility of all workers; therefore, workers need to comply with safety rules and procedures to achieve the required safety priority [66]. Furthermore, in situation where there is overconfidence and a difference in safety attitude, safety supervisors' enforcement of safety rules and procedures achieves significant results in lowering the rate of occupational accidents [67,68].

Therefore, based on the above discussion, safety rules play an important role in lowering the rate of accidents; it is concluded that safety rules and procedures are the most important safety-management practices to prevent workers from occupational accidents that occur.

2.5. Safety Promotion Policies

In total-quality-management models, use of incentives and rewards to motivate employees for safety improvement is an accepted feature of organizational behavioral safety and management [69,70]. In addition, recognition and appreciation of behavioral safety can also increase workers' interests in controlling workplace hazards for self-protection [71]. Therefore, a well-designed and visible rewards system is characterized to modify behavioral safety [72], and also emphasizes achieving the optimum level of safety by reducing workplace accidents [73]. Previous studies have also emphasized that incentives play a most significant role in maintaining workplace safety and positive behavioral safety of workers at the workplace [74]. Moreover, in successful organizations, it was also found that safety-promotion policies have played a significant role in reducing workplace accidents and injuries [75].

Similarly, organizational investment in safety-promotion policies creates employee loyalty and behavioral safety [76]. Based on the discussion, this study recognizes safety-promotion policies as one of the most important safety-management practices. Therefore, in the current study, safety-promotion policies are assessed based on recognition, incentives for safe acts and weekly celebrations, reporting unsafe conditions, and encouraging workers to make safety-improvement suggestions.

2.6. Safety Communication and Feedback

In an organization, various kinds of communication are used to enhance workers' motivational levels in order to maintain workplace safety and development of behavior; for these purposes, two-way communication is important in order to change workers' behavior [77]. The prior investigation of safety literature shows that two-way safety communication with managers and safety leaders plays a most important role as a safety-management practice to reduce occupational accidents and increase workplace safety [78]. Similarly, in the questionnaire survey, safety communication and feedback were included in order to check feedback from various forms of workers, and they showed that safety performance is influenced by the level of communication in the organization [77,79]. Therefore, feedback from managers and safety leaders is important because it provides an opportunity for workers to improve their behavioral safety [80,81]. Furthermore, when safety managers

provide positive feedback [82], it motivates workers' behavioral safety, and negative feedback reduces the frequency of behavioral safety in the future [83]. It has also been suggested that feedback on behavioral safety can be communicated through chats and discussion in safety meetings [84]. Based on the above discussion, this study also accepts that safety communication and feedback is an important safety-management practice.

2.7. Management Commitment to Safety

In organizations, top management is responsible for assigning safety-related assignments, tasks, and establishing work standards and policies to maintain workplace safety [6,85]. Although workers play an important role in improving workplace safety, top management's responsibility is to achieve organizational goals and objectives [86,87].

The review of safety-performance studies shows that management commitment to safety plays an important role [88]. Moreover, in the safety-climate study of Zohar (2010), although other factors contribute to improving workplace safety, management commitment affects safety programs [89]. Moreover, in safety-commitment studies, it was found that management commitment to safety was an important component to the developmenrt of safety culture [90]. There are many ways in which management commitment to safety can manifest, e.g., participation in safety committees, investigation of accidents, review of safety-promotion programs, and safety in job design for employees [91]. Therefore, the investment of top management in safety-improvement programs helps increase employees' loyalty and behavioral safety [92]. Management commitment to safety also changes employee perceptions of how priority is given to workplace safety in the organization [93,94]. Hence, based on the discussion, management commitment to safety plays an important role in workplace safety.

2.8. Safety Compliance

Safety compliance refers to engaging employees in core safety activities such as compliance with the organization's safety rules and procedures [23,57]. Studies on workplace accidents show that a lack of safety compliance was one of the major factors that caused injuries and occupational accidents in the manufacturing industry [95]. From a behavioral-safety perspective, there are two dimensions of behavioral safety. In contrast, safety participation refers to voluntary participation in safety activities and supporting safety in the organization [96]. In the oil and gas industry, considerable attention is given to safety compliance because the investigation of workplace accidents was repeatedly noticed due to a lack of safety compliance. Therefore, noncompliant behavioral safety is considered one of the barriers to workplace accidents [97]. The discussion of the above studies shows the importance of safety compliance for safety-management practices. However, the present study seeks the mediating role of safety compliance for occupational accidents with safety-management practices in Malaysia's oil and gas industry.

2.9. Occupational Accidents

Research shows that around the globe, 270 million occupational accidents occur every year [98], and millions of work days are lost because of poor working conditions. Therefore, most successful companies focus on workers' safety training and safety-promoting activities to reduce occupational accidents [99]. Furthermore, the safety literature identifies the role of safety-management practices in controlling the rate of occupational accidents [4]. Hence, the above-mentioned safety-management practices are considered antecedents of occupational accidents via safety compliance in this study.

3. Methodology

3.1. Procedure and Participants

The current study was conducted in Malaysia's oil and gas industry, and participants were selected from operation and production departments from the downstream sector. One of the main reasons for selecting these participants was that those who work in oil-

extraction processing experience occupational safety challenges [100]. Furthermore, safety literature and reports show that workers in "safety-sensitive" organizations, e.g., oil and gas, experience more workplace injuries and accidents as compared to low-"safety-sensitive" organizations [101,102].

3.2. Measures

A questionnaire survey was collected from employees in Malaysia's oil and gas industry. It contained a series of statements where the participants were asked to rate their agreement on a five-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The study's questionnaire was translated back-to-back from English to Malay and was evaluated by experts in the Malay and English languages [103]. Furthermore, evaluators of the questionnaire had backgrounds in "safety management" and "safety compliance." The safety training was measured with six items adapted from [39], with the following items: "Our company arranges extensive training programs to train employees related to workplace safety issues and challenges"; Moreover, in the organization, "newly joined employees are trained adequately to maintain workplace safety on a formal and informal basis"; "In the organization's safety-training programs, priority of safety is highlighted to lower the rate of occupational accidents and injuries"; "In safety-training programs employees are also trained to respond in emergency situations"; "Special incentives are offered for workers to attend training sessions on workplace safety awareness"; and "Comprehensive hazard assessment training helps to develop and improve knowledge and safety skills". The five items related to workers' involvement were adapted from the source [27], including "In decision making related to safety matters, top management appreciates suggestions from workers in the organization"; "In the safety committee, safety experts and representatives provide mutual suggestions to improve workplace safety"; "Top management welcomes suggestions from workers to promote workplace safety"; "In workplace matters related to safety, issues are also discussed with workers"; and "Workers actively participate in safety-promotion programs to improve workplace safety". Furthermore, regarding safety rules and procedures, six items of were adapted from the source [1]: "In our organization, safety rules and procedures are adequate to lower the rate of accidents and injuries"; "In the department, facilities are sufficient to promote safety rules and procedures"; "Employee motivation is very necessary to maintain; therefore, at the workplace supervisors and managers keep motivating us to maintain workplace safety"; "Safety experts regularly conduct safety inspections to improve safety"; "The effective procedures and practices are adopted in this organization to lower workplace safety"; and "The instructions related to safety rules and procedures are clear in my department". Similarly, items to measure safety-promotion policies were adapted from [104], consisting of five items: "In the organization for employee promotion, safe conduct is encouraged"; "At the workplace, special rewards and incentives are offered to report safety hazards and these rewards are, e.g., (thanked, cash or other rewards, recognition in the newsletter, etc.)"; "The top management of the company arrange a safety week to create awareness about safety importance and risk hazards"; "Employees report when finding unsafe conditions in our section"; and "Unsafe conditions and health-related risks are appreciated when reported in the department". Items to measure safety communication and feedback were adapted from [105]: "Workers have opportunity in their department to report hazards before they occur"; In our organization, top management encourages workers to share ideas about improvements in workplace safety"; "My company has an open-door communication policy, and in the meeting, employees can give suggestions for improvement"; "The goals for safety performance in my organization are clear to the workers"; "There is open communication about safety issues in this workplace"; "I often discuss with my supervisor about safety-related matters"; and "My organization uses social media to create awareness about safety issues in the workplace". Items related to management commitment to safety were adopted from [106]: "Safety is given high priority by the management". "Safety rules and procedures are strictly followed by the management";

"Corrective action is always taken when the management is told about unsafe practices"; "In my workplace, managers/supervisors do not show interest in the safety of workers"; and "Management considers safety to be equally as important as production". However, six items related to safety compliance were adopted from [107], including "I carry out work in a safe manner"; "I use all necessary safety equipment to do my job"; "I use the correct safety procedures for carrying out my job"; "I ensure the highest level of safety when carrying out my job"; "I encourage coworkers to use safety equipment to perform their jobs"; and "Sometimes because of work conditions, I ignore health and safety principles". Similarly, seven items related to occupational accidents were adopted from [108] and all items were measured on a five-point Likert scale, with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The face validity of the instrument helps to measure the subjective validity of items to know the logical concepts through a review of experts in the field [108]. In the current study, validity and content validity were assured before data collection from industry experts and academic experts in relevant fields. Hence, all recommended suggestions were incorporated in the final version of the questionnaire before data collection.

3.3. Sample Size and Data Collection

The oil and gas industry is safety-sensitive, and data collection was challenging because of safety measures. Therefore, a nonprobability convenience-sampling technique was employed for data collection because choosing a sampling technique over another method does not have any bearing on the quality of research [107]. The unit of analysis was individuals from the operation and production departments of Malaysia's oil and gas industry. The sample size for data collection in the study was determined with G* Power version 3.1.9.2, and the minimum sample size was 119 with a 0.80 recommended value. Moreover, requests were sent to the health and safety departments of selected organizations for data collection. The positive responses were received from a few organizations, and online meetings were arranged with safety managers to discuss the purpose of data collection. It was also assured that collected data would not be used for another purpose. In addition, the online questionnaire with the cover letter was sent to "safety managers" to share with workers. The data collection was completed at the end of 2021. The total number of responses received were 311; 280 were valid for analysis and 31 were excluded. The valid sample size of 280 was appropriate for SMART-PLS analysis [109].

4. Data Analysis and Results

The demographic information of respondents is provided in Table 1. The respondents were mostly male, totaling 223 (79.6%), whereas 57 were female (20.4%); 184 (65.7%) were from the operation department, and 96 (34.3%) were from the production department. The majority of respondents—238 (85%)—had a Malay background, while 28 (10%) were Chinese, and 14 (5%) had Indian ethnicity. The educational background of respondents shows that 147 (52.5%) had bachelor's degrees, while 95 (33.9%) had master's degrees, 27 (9.6%) had high school certificates, and 11 (3.9%) were diploma holders. Furthermore, in Malaysia the retirement age is 60 years, and the age information of respondents shows that 126 (45%) were between 20–29 years of age, 89 (31.9%) were between 30–39, 55 (19.6%) were between 40–49, and 10 (3.6%) were between 50–59. Lastly, job experience of respondents with the organization shows that 124 (44.3%) had between 0–5 years' experience, 66 (23.6%) had between 6–10 years, 38 (13.6%) had between 11–15 years, 24 (8.6%) had between 16–20 years, and 28 (10%) respondents had over 20 years of job experience in the organization.

Table 1. Demographic Information.

Demographic	Frequency (N = 280)	Percentage
Gender		
Male	223	79.6%
Female	57	20.4%
Department		
Operation	184	65.7%
Production	96	34.3%
Ethnicity		
Malay	238	85%
Chinese	28	10%
Indian	14	5%
Education		
PhD	0	0%
Master	95	33.9%
Bachelor	147	52.5%
High School Certificate	27	9.6%
Diploma	11	3.9%
Age		
20–29	126	45%
30–39	89	31.8%
40–49	55	19.6%
50–59	10	3.6%
Experience		
0–5	124	44.3%
6–10	66	23.6%
11–15	38	13.6%
16–20	24	8.6%
Above −20	28	10%

4.1. Common-Method Bias Variance

In cross-sectional research, when data is collected from a single source, common-method bias variance cannot be overlooked [110,111]. Therefore, when a single source explains the majority of the variance in a data set, it creates an issue for common-method bias variance [111]. However, in the current study, to evaluate the common-method variance, Harman's one-factor test was employed. The results of the test (see Table 2) show a single factor of 35.35%, which indicates that there was no issue with the data set. Furthermore, another type of common-method bias variance is that if the correlation is greater than 0.90, then there is an issue of common-method bias [112]. Hence, Table 3 shows that all correlation values are in threshold level, and there is no common-method bias variance in the current study.

4.2. Multicollinearity

In the regression model, multicollinearity can be detected through high correlation among independent variables and the study's dependent variable [113]. However, before testing hypotheses of study, the problem of multicollinearity must be confirmed because independent variables should remain independent to interpret the results [114]. In addition, multicollinearity is measured through the variance-inflation factor (VIF) [114,115]; if the variance-inflation factor (VIF) is more significant than 3.33, then there is a potential issue of multicollinearity [116]. In the current study, multicollinearity was measured with the variance-inflation factor (VIF), and values of safety training, worker involvement, safety rules and procedures, safety-promotion policies, safety communication and feedback, management commitment to safety, safety compliance, and occupational accidents were below the 3.33 threshold level of multicollinearity [116]. Therefore, there was no issue of multicollinearity in the current study.

Table 2. The common-method variance outcome.

Extracted Sums of Squared Loadings		
Total	**% Of Variance**	**Cumulative %**
16.61	35.35	35.35

Table 3. Item loading, CR, and AVE.

Variables	Items	Loadings	Composite Reliability	AVE
Safety Training	ST1	0.869	0.941	0.727
	ST2	0.876		
	ST3	0.866		
	ST4	0.877		
	ST5	0.798		
	ST6	0.828		
Worker Involvement	WI1	0.600	0.895	0.635
	WI2	0.885		
	WI3	0.824		
	WI4	0.790		
	WI5	0.853		
Safety Rules and Procedures	SRP1	0.827	0.928	0.683
	SRP2	0.879		
	SRP3	0.758		
	SRP4	0.821		
	SRP5	0.769		
	SRP6	0.896		
Safety-Promotion Policies	SPP1	0.896	0.964	0.842
	SPP2	0.918		
	SPP3	0.942		
	SPP4	0.924		
	SPP5	0.907		
Safety Communication and Feedback	SCF1	0.874	0.938	0.685
	SCF2	0.912		
	SCF3	0.901		
	SCF4	0.863		
	SCF5	0.865		
	SCF6	0.645		
	SCF7	0.694		
Management Commitment to Safety	MCS1	0.971	0.981	0.914
	MCS2	0.964		
	MCS3	0.977		
	MCS4	0.964		
	MCS5	0.902		
Safety Compliance	SC1	0.918	0.973	0.857
	SC2	0.957		
	SC3	0.959		
	SC4	0.955		
	SC5	0.952		
	SC6	0.801		
Occupational Accidents	OA1	0.816	0.963	0.789
	OA2	0.901		
	OA3	0.875		
	OA4	0.799		
	OA5	0.953		
	OA6	0.919		
	OA7	0.941		

4.3. Measurement Model

There are two types of validities measured through measurement model: convergent validity and discriminant validity. However, convergent validity includes factor loading, composite reliability, and average variance extracted (AVE) [117]. Moreover, convergent validity also explains which items are supposed to be theoretically converging on the construct to which they are associated [118]. The item loading in the measurement model should be equal to or higher than 0.7, and if the item loading is lower than 0.7 it should be deleted only if it can improve the average variance extracted (AVE) and the composite-reliability (CR) value [119]. In the current study, item loadings were within the acceptable range, and the average variance extracted (AVE) and composite reliability were also within the threshold level [110,119]. See Figure 1.

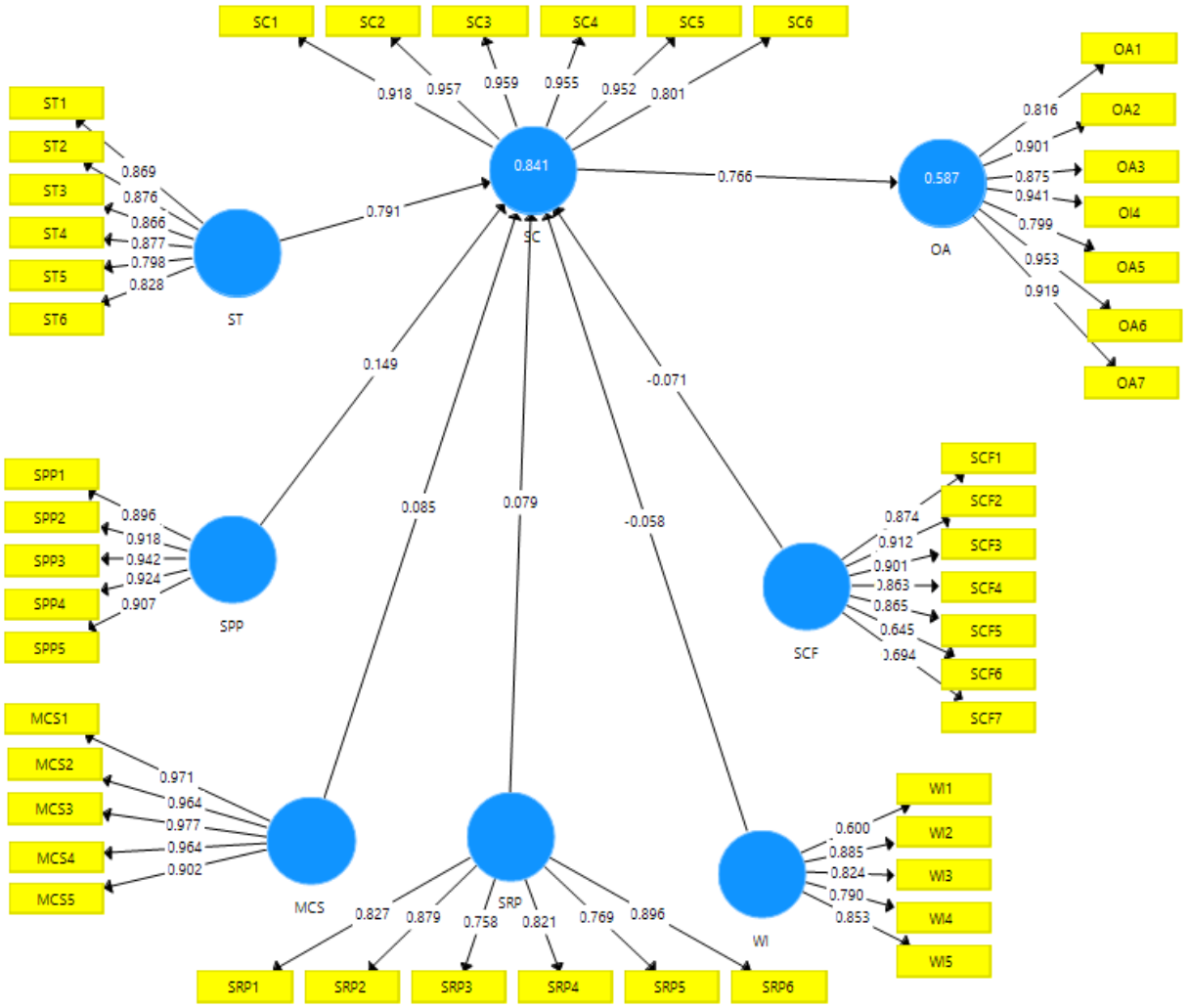

Figure 1. Measurement Model of Study.

4.4. Discriminant Validity

The discriminant validity of items was measured with the Fornell and Larcker (1981) criterion. However, it helps to assess that each construct is different from the other [117]. The criteria to measure discriminant validity is that the root square of all average-variance-extracted (AVE) values should be greater than the correlation values (see Table 4). All diagonal values were greater than the correlation values of all other constructs of the study; hence, Table 4. This shows that all discriminant validity values are within the threshold level and confirms that all items are different from each other.

Table 4. Discriminant Validity of Constructs.

	ST	WI	SRP	SPP	SCF	MCS	SC	OA
ST	**0.956**							
WI	0.051	**0.888**						
SRP	0.248	0.766	**0.925**					
SPP	0.762	0.128	0.217	**0.828**				
SCF	0.408	0.677	0.755	0.386	**0.918**			
MCS	0.332	0.106	0.221	0.291	0.298	**0.827**		
SC	0.187	0.821	0.904	0.202	0.746	0.151	**0.853**	
OA	0.305	0.110	0.183	0.306	0.270	0.525	0.195	**0.797**

Note: Values on the diagonal are square root of the AVEs.

4.5. Structural Model

In structural model 5000, the bootstrapping procedure was recommended [118] to report R^2 values, *t*-values, and β values. However, it was also suggested to report the Q^2 value and f^2 (effect size) [110]. While the "*p*-value" shows the effect, it does not reveal the effect size for the reader [109]. In addition, in the interpretation of results, we also discuss the statistical-significance value (*p*-value) and substantive significance (effect size), and the blindfolding test Q^2 represents the values of the dependent variable for predictive relevance of the study model [117,119]. Hair et al. (2014) stated that Q^2 observed statistical and practical relevance among dependent variables (endogenous) with single and multiple items. The predictive relevance Q^2 of safety compliance (0.444) and occupational accidents (0.711) are greater than zero and meet the threshold level. However, the predictive power of R^2 for safety compliance (0.841) and occupational accidents (0.587) show substantial predictive power for both predictors. Table 5 shows that effect sizes (f^2) of safety training with safety compliance are substantial, and worker involvement with safety compliance was small to medium. Safety rules and procedures and safety compliance also have small-to-medium effect sizes (f^2). However, safety-promotion policies, safety communication and feedback, and management commitment to safety have small-to-medium effect sizes (f^2). However, safety compliance and occupational accidents have substantial effect sizes (f^2) (see Table 5).

Table 5. Results of Hypotheses Testing.

Relationships	β	STEDV	*t*-Value	R^2	f^2	Q^2	Decision	Hypothesis
ST- > SC	0.791	0.051	15.513	0.841	0.656	0.444	Supported	H1
WI- > SC	0.058	0.022	2.621	0.587	0.014	0.711	Supported	H2
SRP- > SC	0.079	0.025	3.201		0.027		Supported	H3
SPP- > SC	0.149	0.058	2.590		0.049		Supported	H4
SCF- > SC	0.071	0.039	1.837		0.013		Not supported	H5
MCS- > SC	0.085	0.046	1.866		0.025		Not supported	H6
SC- > OA	0.766	0.099	7.727		0.412		Supported	H7
ST- > SC- > OA	0.606	0.096	6.342				Supported	H8
WI- > SC- > OA	0.044	0.016	2.688				Supported	H9
SRP- > SC- > OA	0.061	0.018	3.472				Supported	H10
SPP- > SC- > OA	0.114	0.046	2.477				Supported	H11
SCF- > SC- > OA	0.054	0.026	2.101				Supported	H12
MCS- > SC- > OA	0.065	0.029	2.249				Supported	H13

5. Hypotheses Testing

In the current study, thirteen hypotheses were developed based on safety training, worker involvement, safety rules and procedures, safety-promotion policies, safety communication and feedback, management commitment to safety, safety compliance, and

occupational accidents. Seven were direct, and six hypotheses were used as a mediation. The bootstrapping technique was employed to assess the direct hypotheses by using Smart-PLS [109], see Table 5. The first hypothesis of the study confirms a significant path with a value β = 0.791 (t = 15.513, $p < 0.001$), and it is accepted that safety training is impactful for safety compliance. The second hypothesis also shows that β = 0.058 (t = 2.621, $p < 0.001$) and also shows the significant impact of worker involvement for safety compliance, which is accepted. Moreover, the statistical result of H3 β = 0.079 (t = 3.201, $p < 0.001$) and H4 β = 0.149 (t = 2.590, $p < 0.001$) proved that safety rules and procedures and safety-promotion policies have a positive and significant relationship with safety compliance, and both hypotheses have been accepted. The results show that in the fifth hypothesis, safety communication and feedback and safety compliance β = 0.071 (t = 1.837), and management commitment to safety and safety compliance β = 0.085 (t = 1.866), the hypotheses were rejected, and the in last direct hypothesis, safety compliance to occupational accidents β = 0.766 (t = 7.727, $p < 0.001$) was supported.

The predictive relevance ^{Q2} of endogenous-variable occupational accidents and safety compliance was the measure, and the values of Q^2 for safety compliance (0.444) and occupational accidents (0.711) clearly show that all constructs were within meeting an acceptable range. Moreover, the effect size (f^2) was measured for independent variables, e.g., safety training (0.656), which is substantial; worker involvement (0.014), which is moderate to substantial; safety rules and procedures (0.027) which is also moderate to substantial; safety-promotion policies (0.049) which is moderate to substantial; safety communication and feedback (0.013) which is weak; management commitment to safety (0.025), which is also moderate to substantial; and safety compliance (0.412), which is substantial. The hypotheses H8 and H9 predicted that safety compliance would mediate the relationship between safety training and occupational accidents and worker involvement.

The results β = 0.606 (t = 6.342, $p < 0.001$) show that safety compliance mediates the relationships between safety training and occupational accidents; therefore, H8 is accepted. Moreover, safety compliance with values β = 0.044 (t = 2.688, $p < 0.001$) also mediates the relationships between worker involvement and occupational accidents; hence, H9 is also accepted. The results of hypotheses for H10 and H11 also show a strong mediation of safety rules and procedures and occupational accidents via safety compliance, and safety-promotion policies and occupational accidents via safety compliance, respectively, with values β = 0.061 (t = 3.472, $p < 0.001$) and β = 0.114 (t = 2.477, $p < 0.001$). On the contrary, H12 and H13 also provided supposition that safety compliance mediates the relationship between safety communication and feedback and occupational accidents. Safety compliance also mediates the relationship between management commitment to safety and occupational accidents, with results of β = 0.054 (t = 2.101, $p < 0.001$) and β = 0.065 (t = 2.249, $p < 0.001$), respectively.

Hence, results prove that safety compliance mediates the relationships between safety-management practices and occupational accidents.

6. Discussion

The main objective of the study was to examine the impact of safety-management practices on occupational accidents via safety compliance as a mediator. This study was based on the underpinning social-exchange theory [116], which stated that people make decisions consciously and unconsciously based on cost and rewards. It was proposed that safety compliance will mediate between management practices and occupational accidents. As predicted, the results of the study proved that safety compliance mediates safety training, safety-promotion policies, safety rules and procedures, safety communication and feedback, worker involvement, management commitment to safety, and occupational accidents.

This study contributes to the existing literature related to the improvement of workplace safety [22], e.g., occupational accidents, injuries, and safety climate. Secondly, it highlights that limited studies have examined the relationships of safety-management practices to reduce occupational accidents in safety-sensitive organizations via safety com-

pliance [2]. In addition, based on the results of the study, it has been suggested that studies should include measures of safety management and safety compliance [10] to understand their role in safety performance. However, in previous studies, little work had been conducted on safety management to reduce workplace injuries and occupational accidents, and our work extends the existing studies [117].

The current study's findings align with [118], but previous studies operationalized workplace injuries and near misses. In this study, the focus was on occupational accidents and based on results, a gap has been filled in the safety-management literature. Furthermore, it contributes to the existing safety literature of safety compliance for improving workers' behavioral safety. Hence, the study results confirm that safety-management practices are equally important for the oil and gas industry in order to lower the rate of occupational accidents.

Moreover, workers face safety risks in industries such as oil and gas, and future studies should consider both safety compliance and safety-management practices.

7. Conclusions

Effective safety-management practices are extremely important in high-risk operations e.g., oil and gas, to maintain a low rate of occupational accidents. The present study's findings support the social-exchange theory of Blau (1964), which suggested that safety compliance plays crucial role in developing behavioral safety. The study's findings not only proved the direct effect of safety-management practices on occupational accidents but also the indirect effect of safety compliance. Additionally, the literature investigation shows that limited research has been conducted in the South East Asian perspective. Therefore, the current study provides empirical evidence for researchers and practitioners. This study has some important implications. Previously, a safety climate was imperative to maintain workplace safety [119]. However, the current study results indicated that management should focus on improving safety-management practices to lower the cost of safety and occupational accidents with safety compliance. In addition, practical measures are needed to establish the standards for safety compliance. Lastly, the results of our study clearly explain that safety-management practices and safety compliance for high-risk organizations such oil and gas must be prioritized for workers to reduce their risk of occupational accidents. The cross-sectional design of the study was used for data collection because in high-risk organizations, e.g., oil and gas, there was limited time to access industry due to security measures, and secondly, due to a lack of support for data collection at a large scale in Malaysia [11]. Future studies should include measures of, i.e., safety climate, culture, and safety compliance to generalize the results, and comparisons of safety-management practices of practical implications in organizations.

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