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Workplace safety and hazards awareness among the China construction companies in Malaysia

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Abstract. Construction safety continues to be one of the issues that draw the attention of the public. This study aims to investigate the factors to improve awareness towards workplace safety and hazards among the China construction companies in Malaysia. Quantitative research method was adopted in this study. Self-administered questionnaire was extended to 79 workers in China construction company in Malaysia with the use of purposive sampling. Statistical Packages for the Social Sciences (SPSS) and Partial least squares structural equation modelling (PLS-SEM) were used to test the hypothesized relationships. The results show perception and compliance of workers are positively related to the awareness of workplace safety and hazards. On top of that, the study present diverse perspectives towards awareness of workplace safety and hazards by examining the perception and compliance of the workers in the China construction companies in Malaysia. Moreover, high awareness was found to be a significant mechanism leading to lower accidental rates in construction. However, construction projects are getting more in quantity and getting bigger in scale all over the country, future research should consider more factors and include more construction companies. In overall, this study highlights the essential role of workers' perceptions and compliance in raising their safety and hazards awareness in reducing accidental rates in the construction industry.

1 Introduction

1.1 Background of study

Construction is essential to a country's socioeconomic development. Construction involves, but is not confined to, monitoring aspects of new works as well as the repair and maintenance of building and infrastructure structures. The construction industry is

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frequently used to stimulate the country's economic development and is considered as a development catalyst. Numerous construction development trends have evolved since the 1990s, including more private-sector involvement in infrastructure development, enhanced vertically integrated packaging of construction projects, and increased foreign nation engagement in construction development [1]. As a result of this transformation, China is rapidly becoming one of the world's most significant manufacturing and trading centres. This is attributable to technological innovations as well as enhanced financial and management efficiency. Furthermore, since becoming a remarkable environmental power, China has been more universal, deregulated, accessible, and capable than ever before. As a result, the government has stated that Chinese funding are key to support economic growth, upgrading the country's ageing infrastructure, and generating employment for Malaysians [2]. Chinese investments, particularly in the construction industry, have both benefited and negatively impacted the country [3].

Despite the importance of the construction industry, it is unfortunate that it is one of the industries that frequently provides unpleasant work environment. Because of the high frequency of accidents and fatalities, the sector is considered among the most dangerous profession sectors in the country. In reality, the disastrous impact of construction accidents is substantially greater than that of all other industries combined. Despite decades of research into safety and risk assessment, mishaps in the construction sector continue to be the norm.

2 Problem statement

The construction industry is known as the national economic trajectory. Construction, on the other hand, is among the most hazardous industry due to its distinctive, dynamic, and transitory characteristics. Since construction industry is such a crucial component of a country's socioeconomic development, the performance and competency of construction companies should be highlighted in this section. The involvement in Chine investment has brought in certain megaprojects to Malaysia, such as, Belt and Road Initiative and Forest City [4,5]. However, some of these projects have either been cancelled or come to a standstill. This has raised concerns among the local regarding the issues surrounded the China construction firms and their contractors. For instance, quality control, inadequate design capacity and safety performance have always been regarded as factors that not in compliance with the legal aspect [6]. To make the thing worse, the Chinese construction industry has gone up significantly, leading to a lack of experienced and qualified Chinese project managers. Thus, insufficient construction personnel experience may expose projects to hazardous circumstances [6]. In the construction sector, poor safety performance is a major issue. The integrity and longevity of any construction company is based on the competent management of safety, productivity, quality, health, and the environment, which implies that safety performance in a construction is almost as crucial as time, quality, and cost metrics. On the other hand, absence of appropriate safety precautions goes beyond medical issues since the expenditures of construction incidents can have a tremendous effect on financial success of construction organisations and increase the average expenditure of construction projects up to 15% [7]. To overcome such issue, researchers and professionals have started working hard to understand the common injury causal factors in the construction industry. Among all the factors, the role of poor awareness towards workplace safety and hazards has received the most attention [8-10]. However, research that focus in that focus on aspect of workplace safety and hazards awareness is still remain scant to date. This scenario represents a major drawback in the engineering management literature that worth to be address in view of its impact towards the safety of the workforce and overall performance of the industry.

3 Methodology

Current research adopted a quantitative approach whereby a self-administered questionnaire was used as the survey tool to collect data from construction workers in the China construction companies in Malaysia. This research uses partial least squares structural equation modelling (PLS-SEM) to perform the statistical analysis. Data obtained being analysed by using the software, Smart PLS 3. PLS-SEM is a popular approach in social science because it allows researchers to evaluate complicated models with multiple constructs, indicators, and structural paths beyond generating firm distributional presumptions about the input [11-15].

3.1 Sample size estimation

In this study, G*Power was used to estimate the number of samples required for statistical significance. Although the population of the study was unknown the other three parameters (significant criterion, effect size, and power) were fixed. In standard applications, effect size and the error of probabilities are chosen based on conventions. According to [16] α value is usually 0.05. [17] suggested using β=0.20 as standard level.

3.2 Sampling and data collection

The workers at a Chinese construction company in Malaysia were the study's target respondents. The study questionnaire was designed to collect data from respondents at construction sites and construction offices in Malaysia's Klang Valley region because Klang Valley is one of Malaysia's most progressed areas. Purposive sampling was adopted as it's able to obtain valid data from selected respondents. Subsequently, the one and only criterion that has been created to evaluate the qualification of the is that the respondents must be permanent workers in China construction company. The complete data set of 79 observations have reached the minimal sample size analysed by G*Power Analysis. With an effect size of 0.15 and a power level of 80 percent.

3.3 Instrument and measurement

All the items for the measurement scales were adopted from the past research with a five-point Likert scale (from strongly disagree to strongly agree). There are four sections in the self-administered questionnaire. Demographic information was gathered in the first section of the questionnaire while sections two, section three, and section four captured information to measure actual perceptions, compliance, and awareness. The measurements for compliance, perception, and awareness were adopted from [18] and [19] respectively due to the high reliability in the reliability test.

4 Results and discussion

4.1 Respondent's profile

The respondent's profile is summarised in Table 1 below. Based on Table 1, 73.4% of respondents are male, while 26.6% are female. Most respondents (69.6%) are under the age of 30. Malaysians make up 53.2% of the population, while Chinese nationality makes up 43%. Singaporeans have the lowest percentage at 3.8%. In terms of working experience in the construction industry, 86.1% have less than 5 years of experience and only 6.3% have more than 10 years. Most respondents (91.1%) have a safety officer in their workplace, and the majority of them understand workplace safety and hazards.

Table 1. Demographic profile.

Demographic Characteristic		Frequency	Percentage (%)
Gender	Male	58	73.4
	Female	21	26.6
Age	20 – 29	55	69.6
	30 – 39	16	20.3
	40 – 49	5	6.3
	50 – 59	1	1.3
	60 & above	2	2.5
Nationality	Malaysian	42	53.2
	Singaporean	3	3.8
	Chinese	34	43
Year(s) of Working Experience in Construction Industry	1 – 5	68	86.1
	6 – 10	6	7.6
	Above 10	5	6.3
Presence of Safety Officer	Yes	72	91.1
	No	7	8.9
Safety & Hazards Understanding	Yes	71	89.9
	No	8	10.1
Total		79	100.0 %

4.2 Measurement model assessment

Structural equation modelling (SEM) is a method for analysing the cause-effect relationships between latent constructs. PLS-SEM is a cause - effect modelling approach that seeks to maximise the explained variance of the dependent latent constructs. Hence, PLS-SEM method was used in this study. PLS-SEM is the option for research with a smaller sample size [20]. Moreover, PLS-SEM is a cause-effect predictive method to SEM that depends on regression-based techniques mainly in social sciences domains to presume path correlations with latent and manifest variables [21]. PLS-SEM comes with two-stage analysis: measurement model and structural model. Before examining the structural model, the measurement model assesses the reliability and validity of the model's constructs. It entails the analysis of convergent and discriminant validity. In convergent validity, it includes the assessment of composite reliability, factor loadings, and the average variance extracted (AVE).

The results show majority of the item's loadings are larger than the boundary value of 0.70. However, there were two items from the construct of perception were excluded because of poor factor loading and ended up in the value of CR and AVE less than the boundary value. If the outer loadings lie between 0.40 and 0.7, the impact of indicator deletion on the internal consistency reliability should be analysed [22]. If the deletion raises the measure threshold, the inappropriate questions can be removed, but the implications for content validity must be considered. The results are shown in Table 2 below.

Table 2. Measurement model assessment.

Construct	Item	Outer Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)
Compliance	C1	0.846	0.895	0.632
	C2	0.777		
	C3	0.831		
	C4	0.832		
	C5	0.674		
Perception	P1	0.867	0.763	0.525
	P2	0.588		
	P3	0.690		
Awareness	A1	0.743	0.888	0.649
	A2	0.739		
	A3	0.891		
	A4	0.810		
	A5	0.834		

Discriminant validity is measured to prove that these is no correlation between constructs. It also associates to the extent to which the indicators are well defined from others across constructs. Heterotrait-Monotrait Ratio is examined to establish discriminant validity. Usually, the heterotrait-monotrait (HTMT) criterion is recommended for validity testing, with the HTMT statistics should be less than or equal to 0.90. HTMT is the ratio of between-trait correlations to the within-trait correlations. Table 3 below displays all the HTMT values are lower than the maximum value of 0.90. Therefore, discriminant validity for the present study is demonstrated.

Table 3. HTMT ratio.

HTMT	Awareness	Compliance	Perception
Awareness	-	-	-
Compliance	0.674	-	-
Perception	0.707	0.544	-

4.3 Structural model assessment

After the completion of the measurement model assessment, the structural model assessment is followed. The assessment of structural models determines whether there are hypothesized theoretical relationships between the constructs while also outlining the connection between the latent variables. The model's explanatory power is assessed by calculating the amount of variation in the model's dependent variables. The path coefficients and R^2 are the most important metrics for evaluating the structural model. Since PLS-SEM somehow doesn't make the assumption a specific data distribution, significance testing requires the use of resampling techniques such as bootstrapping or blindfolding to measure the parameters' standard errors. Collinearity statistics are used to determine whether the independent variables are highly correlated. Variance inflated factor (VIF) was used to evaluate the collinearity issues. Table 4 shows the results of the collinearity test in the model, in which every VIF values are less than 5.0 Therefore, there was no collinearity issues in the model. Next, Table 4 also shows the level of R^2, effect sizes f^2, and predictive relevance Q^2. R^2 or coefficient of determination reflects the amount of a shared variation between two or more variables or also known as the co-variance. The value of R square obtained for the analysis is 0.497. This reflects a large amount of a shared variation between two or more variables. The effect size of compliance (f^2=0.366) is larger than perception (f^2=0.223). The predictive relevance Q^2 evaluates the approach of the model to its predictions, quality, or accuracy of the model's predictions and should always be greater than 0.

Table 4. Structural assessment model.

	VIF	R^2	R^2 Adjusted	f^2	Q^2
Awareness	-	0.497	0.483	-	0.289
Compliance	1.200	-	-	0.366	-
Perception	1.200	-	-	0.223	-

Table 5 shows the P value that assess the significance and relevance of the structural model relationships in the path coefficients. The path co-efficient of the hypotheses were found to be significant which P values < 0.05.

Table 5. Path co-efficient.

Hypothesis	P Values
H1: Compliance -> Awareness	0.000
H2: Perception -> Awareness	0.000

5 Conclusion

The construction industry is one of the most hazardous of all. Occupational fatalities and lost-time injuries are common among construction workers. Majority of the construction site accidents are avoidable. Safety precautions and performance in a construction project are as important as delivery time, handover quality, and cost of construction project. Accidents and injuries in construction sites have impact to the project cost and tend to be costly in human and financial term. The purpose of this study was to investigate the safety and hazard awareness of Chinese construction companies in Malaysia. The variables discussed were perception and compliance because perception and compliance are critical aspect to enhance safety performances and safety goals. Based on the research obtained, perception and compliance would statistically affect the safety and hazards awareness of the workers among the China construction companies in Malaysia. Thus, focusing on improving the perception and compliance of construction workers will ultimately raise the awareness towards safety and hazards in workplace. In doing so, the rates of accidents can be reduced and hazards at construction sites can be controlled or eliminated. Furthermore, based on the findings, most respondents understood the significance of safety and hazard awareness because of the presence of a safety officer and safety induction by the safety officer. Hence, safety officer played an important role in raising the workers safety and hazards awareness. Overall, it can be concluded that safety in construction projects is a critical component of any construction related notion.

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