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Impact of Safety Management Practices on Safety Compliance Behavior with Mediation of Safety Motivation

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Abstract

Construction projects have many work-related health accidents and injuries, which cost the organization financially and non-financially. Safety management practices play a significant role in overcoming such safety problems. This study aims to examine the influence of safety management practices on safety compliance in construction sites. The study was conducted through questionnaire surveys with 97 respondents from construction sites in Surabaya, Indonesia. Partial least squares structural equations modeling (PLS-SEM) was used to analyze the conceptual model. The research findings suggest management to uplift their workplace safety practices. Furthermore, contractors involved in construction projects can implement health and safety practices to reduce accidents.

Key Words: Health accidents, Safety compliance, Safety management practices.

Introduction

The performance analysis of an industry like construction is of remarkable importance in the economic growth of a nation (Naoum, 2016). The construction industry plays a vital role in the economic growth of a country. In Indonesia, the construction sector is one of the prominent sectors that support economic growth. Cited from (Central Bureau of Statistics, Indonesia BPS, 2018), the construction sector is the third-largest contributor to the Indonesian economy. It provides a total of USD 117 million to the GDP in 2018, representing a share of 11.1% of total GDP. This sector is behind the major industry and trading, which represents 19.8% and 13% of GDP respectively. In 2010, the Indonesia Ministry of Manpower and Transmigration recorded workplace accidents as the most frequent in construction services (31.9%). The health and safety risk at work is still very high, caused by hazardous materials (chemical, biological, toxic, and other harmful substances) widely used in production processes. On the other hand, the occurrence of accidents can negatively influence the output of the construction sector. Hence, it is very important to identify and prioritize the safety practices that assist construction workers to feel safe (Gurmu, 2019).

The construction sector is growing at 7-8% per year (Central Bureau of Statistics, Indonesia BPS, 2018). From 2017 to 2022, Indonesia's construction market is forecasted to grow by 6.6%. In most countries, worker's cost comprises 30% to 50% of the overall project's cost (Jarkas *et al.*, 2011). Every project has some difficulty in construction like material, money, tools, and local contractor's construction cost (Hafez *et al.*, 2014). However, health and safety issues are one of the major challenges faced by the construction industry. If the workers do not feel safe on the construction site, they will not produce the desired output. Construction building is a hazardous activity, which is associated with numerous incidents such as deaths and injuries.

Over the last three decades, various studies have shown safety concerns can help contractors increase the productivity of construction projects (Nasir *et al.*, 2015; Gurmu *et al.*, 2017; Kenley, 2014; Gurmu, 2018). Therefore, in the construction sector, safety issues become a major concern for all kinds of projects, mostly in building construction. The activities of the construction industry have raised serious health and safety concerns amongst governments, health and safety stakeholders, health and safety professionals, and researchers over the past few decades (Enshassi *et al.*, 2007; International Labor Organization (ILO, 2005).

The more an environment is manufacturing-oriented, the heavier machinery and large equipment exist. It means more potential for accidents to occur, leading to huge loss in working hours. That is why safety management practice is a significant strategy to safeguard the lives of all the workers at construction sites. It is one of the main factors studied widely to promote safety compliance (Subramaniam *et al.*, 2016). Safety management practices not only improve working conditions but also positively influence employees' attitudes and behaviors about safety, reducing accidents in the workplace (Vinodkumar *et al.*, 2010). In addition, workers have personal responsibilities toward their health and safety. Therefore, managers need to ensure that workers who do not care about construction safety are motivated by any means to become safety conscious. Therefore, improvement is vital and a safe framework (Fugar, *et al.*, 2010) is needed for all workers. On the other hand, motivation of workers is proposed as one factor that stimulates outcomes in the construction industry (Barg, *et al.*, 2014). Motivation is intangible, a hypothetical construct that explains human behavior (Barg, *et al.*, 2014). Therefore, the employer needs to adopt more holistic strategies and approaches, which focus not only on improving the physical working environment but also on employee's behaviors, attitudes, and beliefs to guide them to safety compliance (Mat *et al.*, 2012). Safety compliance eliminates workplace accidents by practicing high standards of safety and health at work. Thus, it can be concluded that safety management practices, safety motivation, and safety compliance link with each other.

The purpose of this study is to determine the best approach to encourage safety management practices and safety compliance of construction workers by motivating them to adopt safety measures. This study is important because the findings will provide a tool for establishing health and safety consciousness among construction workers in Indonesia.

This research focuses on investigating the main factors affecting the safety issues of workers in the Indonesian construction industry. The effective solution is to have safety management practices to decrease health hazards. Therefore, safety management practices will motivate workers to be conscious about health at the workplace. This paper significantly encourages employees' behavior toward safety compliance to improve health and safety in the construction industry.

Literature Review

In many countries, the construction industry workforce is becoming increasingly older and it is becoming more and more difficult to recruit and retain young workers (Van Duivenbooden, Frings-Dresen, & Ringen, 2005). Despite these challenges, there are only a few studies and research about injury in construction sites. In Ireland, Brenner and Ahern (2000) found that injury was the most repeated reason for absence, followed by infectious disease and musculoskeletal disorders. Hannerz, (2005) found that workers engaged in the construction of the Great Belt Link (1988–1998) had over twice the risk of disability retirement in comparison with economically active men in general. The focus is to promote a safe working environment by complying with safety standards.

Safety management practice plays a major role in creating a safe environment in an organization. A safe environment is thus considered as an interaction of factors such as safety management practices and safety compliance (Vinodkumar et al., 2010). Safety management practice is a key to eliminating work-related accidents and injuries. Therefore, the present study intends to investigate the role of safety motivation in the relationship between safety management practices and safety compliance. Safety management practices are the strategies, procedures, and activities implemented by the organizational management for employees' safety (Vinodkumar et al., 2010). Barling (2001) found that safety management practices can address threats and situations that can stimulate the occurrence of human errors by raising the safety standards in the organization. Hence, it prevents occupational accidents and injuries. Although previous research has been done on various components of safety management practices, the following safety practices have been widely considered: management commitment, safety training, safety rules, and procedures, workers' involvement, safety promotion policies, and safety communication and feedback (Vinodkumar et al., 2010; Subramaniam et al., 2016).

When a safety program is implemented, safety compliance is one major part that accomplishes the project. The influence of safety management practices on safety compliance demonstrated in this study is consistent with previous works (Vinodkumar et al., 2010; Subramaniam et al., 2016). This study is designed based on the findings of Campbell et al. (1993) explained that safety motivation mediates the relationship between safety management practices and safety compliance. The purpose of this study is to investigate the direct and mediating effects of safety motivation on the relationship between the six safety management practices and safety compliance in health accidents

that take place in construction sites. This study was conducted in construction sites in Surabaya City, Indonesia.

Based on the above arguments, we propose the following hypotheses:

H_1: Safety Management Practices have a positive and significant effect on Safety Compliance.

H_2: Safety Management Practices have a positive and significant effect on Safety Motivation.

H_3: Safety Motivation has a positive and significant effect on Safety Compliance.

H_4: Safety Motivation mediates the positive relationship between Safety Management Practices and Safety Compliance.

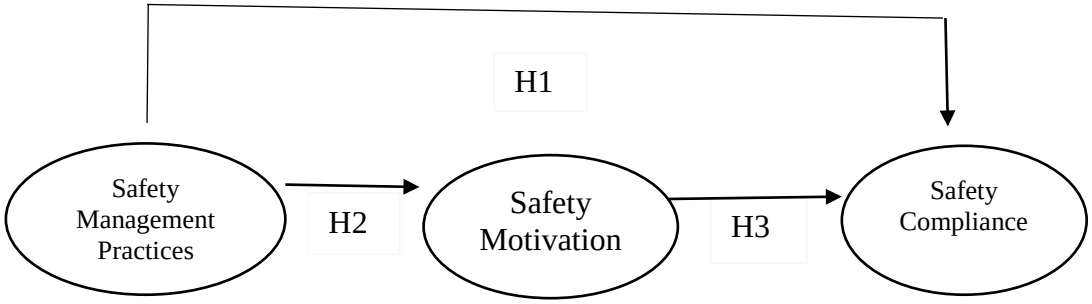

Figure 1. Conceptual Framework

To collect data, we conducted a survey among workers in the construction sector located in East Java, Indonesia, particularly in Surabaya, the second-largest city in the country.

Method

Research Sample

This research was performed in the multi-story Building of Universitas Airlangga named Airlangga Lecture Hall in UNAIR Campus C, and Syariah Tower in UNAIR Campus B. The survey was conducted on 97 workers working there. Primary data were used for the research. The questionnaires were prepared in English as well as the local language (Indonesian Bahasa) based on the feedback from the workers. The survey was conducted for two weeks. Table 3 describes the demography of workers involved in the survey.

Measures

The measures of safety management practices, safety motivation, and safety compliance were taken from Vinodkumar and Bhasi (2010), who developed the instruments. The final questionnaire contained 24 items. Each item was measured on a Likert scale. A Likert scale is a type of response scale often used in questionnaires and is the most widely used scale in survey-based research questionnaires (Geller *et al.,* 1996; Grote, et al., 2000). In

this research, respondents were asked to give their preference on a 5-point Likert scale (strongly disagree, disagree, neither disagree nor agree, agree, and strongly agree) in order to evaluate the respondents' level of agreement with each item. All items were measured on a five-point Likert scale ranging from '1' 'strongly disagree' to '5' 'strongly agree'.

Analysis Techniques

This study was conducted using the partial least squares (PLS) model, which is a variance-based structural equation modeling technique (Henseler *et al.*, 2009), to test the research model depicted in the figure. PLS estimates the dependent variables (Chin, 2010).

Partial least square is a multivariate statistical technique that can handle many variables responses and explanatory variables all at once. This analysis is a good alternative to the multiple regression analysis methods and principal component regression because this method is more robust or invulnerable. Even indicators with a scale of data categories, ordinal, intervals to ratios can used. Another advantage is that the sample size does not have to be large.

Table 1: *Analysis of Demographic Data*

Category		No of Workers	Percentage
Gender	Male	53	54.64
	Female	44	45.36
Education	Middle	50	51.55
	High School	42	43.30
	Diploma	5	5.15
Type of Employment	Temporary	44	45.36
	Permanent	9	9.28
	Contract	44	45.36

Source: PT. Brantas Abipraya and PT. Sasmito, (2020)

Result and Discussion

Measurement Model

First, the measurement model was tested for convergent validity. This was assessed through factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE). The loadings were well above the acceptable threshold value of 0.707 (Hair et al., 2009; Hair et al., 2013). With regard to the construct validity, all constructs achieved a value of composite reliability greater than 0.707 (Nunnally, 1994). The convergent validity was assessed through the average variance extracted (AVE), suggested to be greater than 0.5 (Fornell and Larcker, 1981).

Table 2. *Measurement Model: Loadings, Construct Reliability and Validity*

Construct	Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Safety Management Practices	0.930	0.941	0.526
Safety Motivation	0.913	0.935	0.743
Safety Compliance	0.734	0.835	0.560

Source: PLS output

Table 2 shows that all the loading values are above the preferred value of 0.707, as a result, the proposed constructs of the conceptual model are considered reliable for their indicators' consistency. In addition, the composite reliability values are above 0.7 for the constructs; thus, all constructs are considered reliable. In this study, all variables show AVE values greater than 0.5.

After the reliability test, the model is analyzed for discriminant validity. Table 2 shows that the square root of the AVE (diagonal values) of each construct is larger than its corresponding correlation coefficients, pointing towards adequate discriminant validity (Fornell & Larcker, 1981).

Structural Model

Path analysis was conducted to test the four hypotheses formulated earlier. This is done by assessing R^2 values and Q^2 (redundancy) test for predictive relevance. Figure 2 illustrates the results of the structural model path analysis. Figure 1, the R^2 value for this research model is 0.874, which implies that 87.4% of the variance in Safety Compliance is explained by the

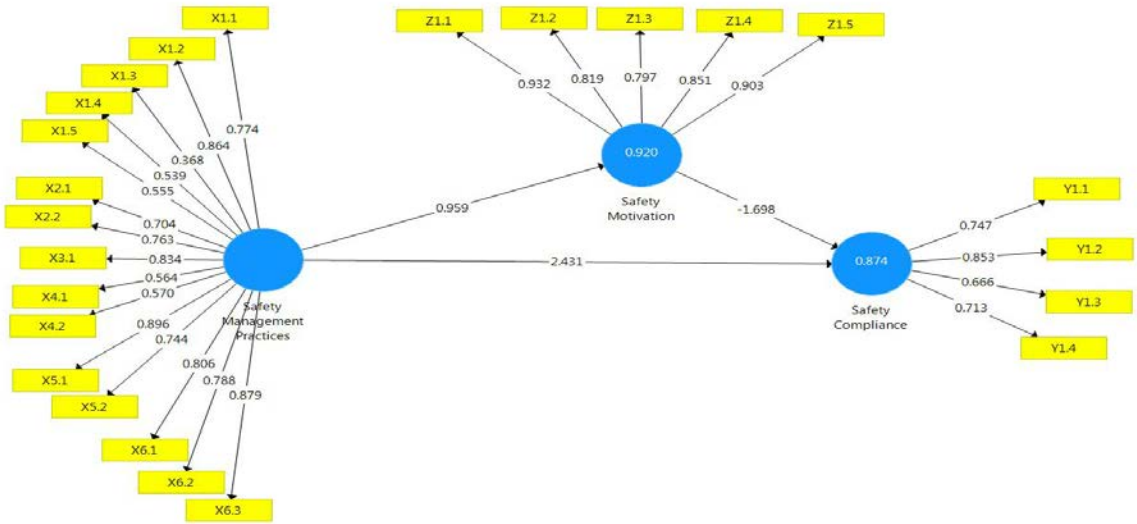

Figure 2. Result of Path Analysis with AMOS

independent variable "Safety Management Practices" and mediating variable "Safety Motivation".

Further predictive relevance of Q^2 was conducted to analyze additional model fit. For predictive relevance, $Q^2>0$ means that the model has predictive relevance, whereas $Q^2<0$ means the model lacks predictive relevance. The blindfold procedure was performed to analyze the predictive relevance, and the result indicates that the Q^2>zero (see Table 3), implying that the model has predictive relevance (Chin, 2010). As a result, the model exhibited an acceptable fit and high predictive relevance.

Table 3. *Blindfolding Result*

Construct	Q^2
Safety Compliance	0.475

Bootstrapping was done to calculate standard errors and t-values, which allows the evaluation of the statistical significance of the path coefficients (Hair et al., 2011). A significant path is ascertained when the p-value is below 0.01 (t-value > 2.33) and 0.05 (t-value > 1.65) respectively for one-tailed test and two-tailed tests. As presented in Table 4, the corresponding t-value and P-value for the B-value determine the significance of the supposed relationship between constructs in the structural model. From the above table, it is clear that safety management practices have a positive and significant effect on safety compliance given t = 9.472 and p = 0.000. In addition, safety management practices have a positive and significant effect on safety motivation given t = 120.822 and p=0.000. Similarly, safety motivation has a positive and significant effect on safety compliance given t = 5.545 and p = 0.000.

Table 4. *Hypothesis Testing: Bootstrapping Effect*

	Hypothesis Relation	SE	t	Sig.
H1	SMP ⇨ SC	0.257	9.472	0.000
H2	SMP ⇨ SM	0.008	120.822	0.000
H3	SM ⇨ SC	0.306	5.545	0.000
H4	SMP ⇨ SM ⇨ SC	0.300	5.430	0.000

The bootstrapping procedure (5000 resamples) described by Hayes (2009) was adopted to test the mediation hypothesis (H4). Lastly, safety motivation mediates the relationship between safety management practices and safety compliance. Hence, it can be concluded that all hypotheses formulated are accepted which has a positive and significant effect on the corresponding constructs in this study. Table 4. Presents the summary of the hypothesis testing of this study.

Discussion

The main purpose of this study is to test the direct and mediating role of safety motivation on the relationship between safety management practices and safety compliance. Furthermore, we also examined dimensions and indicators of safety management practices (management commitment, safety training, workers' involvement, safety communication and feedback, safety rules and procedures, and safety promotion policies). The influence of safety management practices on safety compliance established in this study is consistent with previous research (Vinodkumar et al., 2010; Subramaniam et al., 2016).

The next purpose of this study is to test the direct effect of safety management practices on safety compliance and the indirect effect of safety management practices on safety compliance through safety motivation mediation. We followed two stages of analytical procedures for SEM to test the measurement model (validity and reliability of the measures) and then examined the structural model (Hair, Hult, Ringle, & Sarstedt, 2013). Because structural equation modeling (SEM) requires data not to violate the assumption of normality, the normality of the data was tested. Moreover, the bootstrapping (5000) was used to test the hypothesis (Hair et al., 2013). The primary contribution of this study is to highlight the importance of safety management practices in construction sites.

A significant path is ascertained when the p-value is below 0.01 (t-value > 2.33) and 0.05 (t-value > 1.65) respectively for a one-tailed test and two-tailed test (Hair et al., 2011). From Table 4., it is clear that all hypothesis accepted has a positive and significant effect. More importantly, safety management practice plays a significant role in the safety compliance of workers. In previous studies, safety compliance has been generally treated as safety outcomes (Vinodkumar and Bhasi, 2010). Our results suggest the importance of workers' behavior toward the development and promotion of a safe environment in construction sites.

The present study investigated the relationship between six safety management practices and safety compliance. The results suggest that safety management practices are important determinants of safety. This research can also help in the development of measurement systems to evaluate the effectiveness of safety management practices.

This study failed to explain the direct effect of the six management practices on the safety compliance of construction workers since the study was carried out for a short period. Safety skills could have been included as the determinant of safety compliance, which is consistent with previous work (Vinodkumar et al., 2010). Safety skills may encourage the health and safety of workers.

Conclusion

The aim of this study is to explore the unique factors that affect safety compliance in construction sites in Surabaya, Indonesia. Safety Compliance is supposed to be one of the most important factors affecting the overall change process in such areas. The findings of this study have significant implications for construction sites, specifically for the health and safety of workers. The findings inform us of the need for health and safety to enhance

their commitment to the workplace as part of the promotion of a safety culture. Apart from safety management practices, other organizational factors that may contribute to safety compliance, such as the role of leadership and the HR system, should also be considered. Last but not least, managers should pay more attention to establishing a systematic training program for the workers. In addition, they have to conduct a reward and promotion system to get their employees involved in the new plans. This research was conducted on construction sites in Surabaya. Hence, it is suggested to conduct the study in other cities of Indonesia, and if possible other countries as well, to compare the results.

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