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Determinants of Construction Workers' Safety Performance: Examining the Effects of K3 Implementation, Safety Training, Safety Leadership, and Work Discipline

Original Article

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Abstract

The construction project is a risky undertaking that involves exposure to several types of occupational hazards. Consequently, it is necessary to improve the safety performance of construction workers to ensure the successful completion of the project and reduce risk at the workplace. This study will analyze the factors affecting safety performance by looking at the impact of K3, safety training, safety leadership, and work discipline on safety performance. A quantitative explanatory research approach was applied in this study, whereby a sample of 150 construction workers was identified via a survey technique. Data collection was carried out using structured questionnaires rated on a five-point Likert scale and analyzed using multiple linear regression with SPSS software. The results reveal that K3 implementation, safety training, safety leadership, and work discipline have a positive and significant impact on safety performance. Out of all four variables, work discipline affects safety performance the most, followed by safety leadership, K3 implementation, and safety training. In this respect, the model has an explanatory power of 67.9%.

Keywords: K3 Implementation, Safety Training, Safety Leadership, Work Discipline, Safety Performance, Construction Workers

1. Introduction

The construction industry is one of the most crucial sectors in contributing to the economic development of a nation. It is responsible for providing essential services in the form of roads, bridges, buildings, and other public utilities necessary for social and economic activities. While it plays a very vital role in the development of a country, the construction industry has been known to be among the most dangerous industries due to the occupational risks associated with it (Čuš-Babič et al., 2014; Gordin & Matetskaya, 2011). Workers in this industry are usually at risk of falling from heights, accidents related to machinery, electricity dangers, mishandling of materials, and poor working environments. As a result of these, there is usually an occurrence of workplace accidents, injuries, disabilities, and even deaths (Beal, 2015).

Definition of safety performance involves the degree to which employees observe the rules and take part in the activities that will ensure their safety at the place of work. The benefits

of high safety performance include reduction of accidents, reduced financial expenses, improved production, and good organizational image (Kantor et al., 2024). On the other hand, low safety performance may result in dire results such as delays in projects, increase in compensation expenditures, punishments, and losing human resources (Meutia et al., 2022). Safety performance of employees in the construction industry is affected by various organizational and personal factors. It is vital to comprehend them to formulate strategies for creating safe environment (Moynihan et al., 2022).

A number of factors that may influence safety performance include the implementation of Occupational Health and Safety (Kesehatan dan Keselamatan Kerja/K3) programs. Implementation of K3 programs includes policies, procedures, risks assessment, safety inspection, hazard controls, and provision of personal protective equipment (Chen et al., 2022). Good implementation of K3 programs allows organizations to identify and reduce potential risks at work places before an incident occurs. In addition, good K3 system creates an environment where workers understand the importance of safety rules (Patel et al., 2022). Prior research has shown that organizations which have good occupational safety and health management system are less prone to accidents. For this reason, K3 programs are believed to have a great impact on construction workers' safety performance (Dollard et al., 2012).

Another factor that could affect the safety performance of an organization is the provision of safety training. Safety training is meant to empower workers with all the necessary skills and information needed to help them recognize the hazards around them and act accordingly during emergencies (Kanabi, 2019). The construction site poses complicated tasks and environments that need the constant updating of the safety skills of the workers. Through proper and adequate safety training programs, the workers would be able to acquire knowledge regarding the safety risks in the work environment and learn how to conduct themselves in a safe manner (Susilo & Navarro, 2023).

Apart from the impact of K3 implementation and safety training, safety leadership and work discipline are also viewed as vital elements that can affect construction workers' safety performance. Safety leadership implies the ability of the supervisors and managers to show commitment to safety issues, set expectations regarding safety issues, support employees and act as safety role models. In this way, safety-minded leaders can motivate employees to obey safety policies and take part in safety activities. On the other hand, work discipline can be understood as employees' compliance with rules and procedures of the organization, especially concerning safety practices. Employees that have high level of work discipline can be expected to obey safety rules, use personal protective equipment properly and avoid engaging in dangerous actions. Although previous research has already considered these variables separately, there is still a gap in research regarding the joint impact of these factors on construction workers' safety performance. For this reason, the current paper attempts to consider the impact of K3 implementation, safety training, safety leadership and work discipline on construction workers' safety performance.

In spite of all the endeavors to enhance the safety of jobs in the construction sector, the number of accidents and unsafe behavior of construction employees are still common in many construction projects. Safety issues arise due to poor implementation of K3, inadequate safety training, poor safety leadership, and lack of work discipline among others. The above issues prove that the level of safety performance of construction workers is not up to the required

standards. In addition, previous studies have indicated the factors related to workplace safety but the level of effect of K3 implementation, safety training, safety leadership, and work discipline on the safety performance of construction workers remains unknown.

The purpose of this research is to determine the factors affecting construction workers' safety performance, taking into account the effects of K3 implementation, safety training, safety leadership, and work discipline. More precisely, this research is aimed at investigating both the separate and the joint impact of the listed above factors on safety performance of construction workers. The outcomes of the research will help create efficient strategies of safety management, develop a positive safety culture within organizations, decrease accidents in the workplace, and increase performance of construction projects as a whole.

2. Method

The current research utilizes a quantitative approach in research design for the purpose of investigating the impacts of K3 implementation, safety training, safety leadership, and work discipline on safety performance of construction workers. The quantitative approach is suitable for this study as it facilitates objective measurement of the relationships between variables as well as testing of the hypotheses that have been formulated. In this study, the subjects under investigation are construction workers working on construction projects where safety performance is very important in realizing organizational/project goals. The independent variables in this study include K3 implementation, safety training, safety leadership, and work discipline whereas the dependent variable is safety performance of construction workers.

The population of the study comprises construction workers working in various construction projects at selected construction sites. A sample is obtained from the population based on probability or non-probability sampling method, according to the accessibility of the construction sites and conditions prevailing in the construction projects. Data is collected using a structured questionnaire provided directly to respondents. Respondents' perception concerning each research variable is measured using a five-point Likert scale with scores from 1 (strongly disagree) to 5 (strongly agree). Measurement of indicators of K3 adoption involves safety policy, hazard control, and personal protective equipment. Measurement of indicators of safety training involves safety training frequency, relevance, and effectiveness. Measurement of indicators of safety leadership involves safety management commitment, communication, and supervision.

Data gathered are analyzed statistically using statistical packages such as SPSS and SmartPLS. Before conducting the hypothesis testing process, tests for validity and reliability of research instruments are done to assure that the research instrument is of good quality. Statistical descriptive analysis is used to give descriptive information about respondents and research variables, while inferential statistical analysis is used to test relationship between variables. Multiple linear regression analysis or Partial Least Squares Structural Equation Modeling (PLS-SEM) will be used to test both individual and simultaneous impacts of the implementation of K3, safety training, safety leadership, and work discipline on safety performance of construction workers.

3. Results and Discussion

The data collection was done on 150 construction workers who were involved in the study. To test the hypotheses, descriptive statistical analysis and multiple linear regression analysis were conducted to analyze the characteristics of the data and the relationship between the independent variables (K3 Implementation, Safety Training, Safety Leadership, and Work Discipline) and the dependent variable (Safety Performance). The analysis was carried out using SPSS 26 software. The results of the statistical analysis are presented in the following tables.

3.1. Descriptive Statistics

Table 1. Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
K3 Implementation	150	2.00	5.00	4.12	0.56
Safety Training	150	2.00	5.00	4.05	0.61
Safety Leadership	150	2.00	5.00	4.18	0.53
Work Discipline	150	2.00	5.00	4.21	0.49
Safety Performance	150	2.00	5.00	4.25	0.51

Source: Data Analysis

Table 1 presents the descriptive statistics for the study variables based on responses from 150 participants. Overall, the results indicate that respondents reported positive perceptions across all variables, with mean scores ranging from 4.05 to 4.25 on a five-point Likert scale. Among the variables, Safety Performance recorded the highest mean score (M = 4.25, SD = 0.51), indicating that respondents perceived the level of workplace safety performance to be high. This was followed by Work Discipline (M = 4.21, SD = 0.49), suggesting that employees generally demonstrated a high level of discipline in complying with organizational rules and safety procedures. Safety Leadership also received a high evaluation (M = 4.18, SD = 0.53), reflecting positive perceptions of leadership in promoting workplace safety.

K3 Implementation achieved a mean score of 4.12 (SD = 0.56), indicating that occupational health and safety (K3) practices were implemented effectively within the organization. Safety Training had the lowest mean (M = 4.05, SD = 0.61), although it still reflects a favorable assessment of the organization's safety training programs. The standard deviation values, ranging from 0.49 to 0.61, indicate relatively low variability in respondents' answers, suggesting that participants' perceptions were generally consistent across all variables. The minimum and maximum values show that responses covered a broad range while remaining within the expected measurement scale.

3.2. Regression Analysis

Table 2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.824	0.679	0.670	0.293

Source: Data Analysis

Table 2 presents the model summary of the multiple linear regression analysis examining the effects of K3 implementation, safety training, safety leadership, and work discipline on safety performance. The R value of 0.824 indicates a strong positive relationship between the independent variables and safety performance. This suggests that improvements in K3 implementation, safety training, safety leadership, and work discipline are strongly associated with better safety performance. The R Square (R^2) value of 0.679 indicates that 67.9% of the variation in safety performance is explained jointly by K3 implementation, safety training, safety leadership, and work discipline. The remaining 32.1% of the variation is attributable to other factors that were not included in the regression model. The Adjusted R Square value of 0.670 shows that, after accounting for the number of predictors and sample size, approximately 67.0% of the variance in safety performance is explained by the regression model. The small difference between R Square (0.679) and Adjusted R Square (0.670) indicates that the model is stable and has strong explanatory power.

Table 3. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	26.318	4	6.580	76.621	0.000
Residual	12.452	145	0.086		

Source: Data Analysis

Table 3 presents the results of the Analysis of Variance (ANOVA) for the multiple linear regression model. The ANOVA test was conducted to determine whether K3 implementation, safety training, safety leadership, and work discipline jointly have a significant effect on safety performance. The results show that the regression model produced an F-statistic of 76.621 with a significance value of 0.000 ($p < 0.001$). Since the significance value is below the 0.05 threshold, the regression model is statistically significant. This indicates that the independent variables, when considered simultaneously, have a significant effect on safety performance. The regression sum of squares (26.318) is substantially larger than the residual sum of squares (12.452), demonstrating that the model explains a considerable proportion of the total variation in safety performance. Furthermore, the residual mean square of 0.086 indicates that the unexplained variance in the model is relatively small.

Table 4. Coefficients

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	0.721	0.284	–	2.539	0.012
K3 Implementation	0.231	0.067	0.248	3.448	0.001
Safety Training	0.189	0.061	0.214	3.098	0.002

Safety Leadership	0.274	0.073	0.286	3.753	0.000
Work Discipline	0.301	0.069	0.319	4.362	0.000

Source: Data Analysis

Table 4 presents the results of the multiple linear regression analysis examining the effects of K3 implementation, safety training, safety leadership, and work discipline on safety performance. The findings indicate that K3 implementation has a positive and statistically significant effect on safety performance (B = 0.231, β = 0.248, t = 3.448, p = 0.001). This suggests that better implementation of occupational health and safety (K3) practices contributes to improved safety performance. Safety training also has a positive and significant influence on safety performance (B = 0.189, β = 0.214, t = 3.098, p = 0.002). This finding implies that providing effective safety training enhances employees' ability to work safely and improves overall safety performance. Similarly, safety leadership significantly affects safety performance (B = 0.274, β = 0.286, t = 3.753, p < 0.001). This indicates that strong leadership in promoting and enforcing workplace safety positively influences employees' safety behaviors and performance. Among all independent variables, work discipline has the strongest effect on safety performance (B = 0.301, β = 0.319, t = 4.362, p < 0.001), as evidenced by the highest standardized beta coefficient. This suggests that employees who consistently comply with organizational rules and safety procedures are more likely to demonstrate superior safety performance. The constant value of 0.721 (p = 0.012) represents the expected level of safety performance when all independent variables are assumed to be zero.

3.3. Discussion

From the findings of this study, it is clear that the adoption of K3, safety training, safety leadership, and work discipline has very positive impacts on the safety performance of construction workers. From the coefficient of determination (R^2=0.679), it is apparent that these factors together account for 67.9% of the variance in safety performance. This result clearly points out that the safety performance is largely dependent on organizational safety policies and personal behavior. These results support the theoretical standpoint that safety at work places is not only about technical safety but also involves managerial commitment, competence of employees, and compliance with organizational rules.

These results indicate that K3 has a positive and significant influence on the safety performance of construction workers. The positive result indicates that the implementation of occupational safety and health program positively influences safety compliance and involvement of employees. In construction projects where there is continuous implementation of safety policy, hazard assessment, provision of PPE, and application of risk control mechanisms, the safety level increases and workers are motivated to follow safe behavior practices. The results are consistent with previous research which has highlighted the importance of occupational safety and health management system in reduction of accidents at workplace. Workers are more inclined towards following safety regulation when they feel that safety is an important aspect for their organization.

Safety training is another variable that was seen to significantly positively impact safety performance. This means that employees who are well-trained are better able to identify risks and undertake tasks in a safe manner because of having the right knowledge and skills. In an industry like construction, which involves exposure to changing and risky situations, training becomes an important tool for improving safety performance. By going through training programs, employees are able to get knowledge about the right safety practices, the way to handle emergencies, and the right use of personal protective equipment. It means that trained employees are able to avoid accidents and engage in fewer unsafe activities.

Moreover, it is revealed that safety leadership has an enormous impact on the safety performance of construction workers. When leaders promote safety activities, communicate safety expectations, give guidance, and exhibit commitment towards safety, they build a safety climate in the organization. Workers tend to follow the example set by their leaders; therefore, leaders who always take safety into account can motivate workers to practice safe behavior at workplace. Leadership for safety improves the level of confidence of employees in safety activities and motivates them to be part of the safety programs. This finding provides evidence that leadership plays an important role in developing a safety culture and affecting the safety-related behavior of workers. Therefore, construction firms need to motivate their leaders to acquire competencies related to safety.

Out of all variables studied in this research, work discipline became the most significant determinant of safety performance. This finding implies that people who always abide by organizational rules, use procedures and show responsibility in their work can perform better concerning safety performance. Many accidents happen in the construction industry because of unsafe behavior of employees, carelessness, or non-compliance with safety rules. Thus, disciplined workers would not take part in hazardous activities and always use personal protection means, follow operations procedures, and report hazards. High significance of work discipline emphasizes the importance of creation of an accountable environment for construction organizations. The management should introduce safety rules and standards and apply appropriate motivation techniques to ensure discipline among workers.

From the above discussion, it is clear that improving safety performance among construction workers requires a combination of various elements. Organizations have to ensure they reinforce K3 compliance by developing safety policy and hazard control systems, offering proper safety training, fostering safety leadership among their supervisory and managerial staff, and creating work discipline. By doing all this at once, organizations will be able to foster a strong safety culture, reduce accidents in workplaces, and realize success in projects. The findings of this study add to existing literature on occupational safety in the construction industry.

4. Conclusion

Based on the results obtained from this study, it can be concluded that K3 implementation, safety training, safety leadership, and work discipline greatly affect safety performance of construction workers individually and together as a whole. It shows that proper implementation of the practices related to occupational health and safety, good safety training program, good safety leadership, and discipline greatly impact on safety performance and

involvement of construction workers in this area. Out of all these variables discussed above, work discipline was the one that had the greatest impact on safety performance of construction workers, followed by safety leadership, K3 implementation, and safety training. Moreover, regression analysis shows that all these variables account for a large amount of variance in the safety performance of construction workers, which shows how important it is for the creation of a safe environment at work.

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