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K3 Risk Analysis of the Construction of the 2nd Floor Mabarrot Hasyimiyah NU Manyarejo Manyar Clinic Gresik

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Abstract

This study aims to analyze Occupational Safety and Health (OSH) risks in the construction of the second floor of the Mabarrot Hasyimiyah NU Clinic, located in Manyarejo, Manyar, Gresik.

Construction projects are inherently high-risk environments, particularly in structural and high-altitude work. A quantitative descriptive approach was employed using a questionnaire distributed to 50 respondents consisting of workers, workers, and safety supervisors.

The collected data were analyzed using validity and reliability tests, multiple linear regression, and mean evaluation. The results indicate that among the three independent variables (OSH management, work accidents, and occupational diseases), only OSH management has a statistically significant effect on OSH risk potential. The mean analysis also revealed that most respondents perceived supervision and OSH management effectiveness as satisfactory, although exposure to hazardous materials and serious accidents remained critical concerns. This study is expected to provide a basis for contractors to improve their OSH systems and serve as an academic reference for future research in construction risk.

Keywords: OSH Risk, OSH Management, Construction Work, Linear Regression, Risk Evaluation.

1. Introduction

Construction projects are inherently exposed to various risks, particularly in terms of Occupational Safety and Health (OSH)[1]. The construction of healthcare facilities requires not only structural safety but also strict safety management during execution [2]. The construction industry is known as one of the sectors with the highest accident rates due to hazardous activities such as working at heights and handling heavy equipment[3], [4]. Effective OSH management is therefore essential to reduce risks and improve project performance.

Previous studies indicate that inadequate safety planning and poor supervision are major contributors to workplace accidents[5]. However, limited research focuses on OSH risk analysis in small-scale clinic construction projects.This study aims to analyze OSH risks and identify the dominant factors affecting safety performance in the Mabarrot Hasyimiyah NU Clinic construction project. Risk in construction projects cannot be completely eliminated, but it can be reduced or transferred from one party to another[3]. When risks occur, they can disrupt overall project performance, which in turn can lead to losses in costs, time, and quality of work. Construction industry players are increasingly recognizing the importance of managing risk in the projects they manage.

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Mistakes in estimating and managing risks can have negative impacts, both directly and indirectly,on construction projects. These risks can result in increased costs and delays in project completion. Risks in construction projects cannot be completely eliminated, but they can be reduced. Therefore, implementing risk management in construction projects is crucial to maximize opportunities and minimize potential risks. This is relevant in the context of the Mabarrot Clinic Construction Project, Floor 2, in Manyar District, Gresik Regency. Given the importance of risk management in construction projects, the authors conducted research on the project, focusing on workplace accidents that occurred at the project site. This research involved data collection using a questionnaire to analyze the accident risks arising from the lack of risk management implementation in construction projects.

Infrastructure development plays an important role in improving public welfare and supporting socio-economic development. One of the important infrastructures in supporting community welfare is healthcare facilities such as clinics and hospitals. The construction of healthcare facilities must be carried out carefully to ensure that the resulting building meets functional, structural, and safety requirements. In addition to structural safety after the building is completed, safety during the construction process is also an important factor that must be considered[6]. The construction industry is widely recognized as one of the sectors with the highest occupational accident rates worldwide. Construction work often involves hazardous activities such as working at heights, operating heavy machinery, handling hazardous materials, and working in dynamic environments. These conditions increase the likelihood of workplace accidents and occupational health risks. According to international safety reports, construction workers are several times more likely to experience workplace accidents compared to workers in other industries[4].

Occupational Safety and Health (OSH) management is therefore essential in construction projects to prevent accidents and protect workers. The implementation of OSH management systems aims to identify potential hazards, assess risks, and implement appropriate control measures to minimize workplace accidents. In Indonesia, the implementation of OSH is regulated through Law No. 1 of 1970 concerning Occupational Safety and Government Regulation No. 50 of 2012 concerning the Occupational Safety and Health Management System (SMK3). Risk is an inherent element in construction projects and cannot be completely eliminated. However, risks can be managed through systematic identification, assessment, and mitigation strategies. Effective risk management can significantly reduce project uncertainty and improve project performance[5]. Poor risk management may lead to increased costs, project delays, and safety incidents that negatively affect workers and project stakeholders.

Several previous studies have emphasized the importance of implementing effective safety management systems in construction projects. Identified that inadequate safety planning and supervision are major contributors to construction accidents[7]. Reported that risk assessment methods are effective tools for identifying potential hazards and determining appropriate mitigation strategies[6]. Despite the importance of safety management, many construction projects still experience safety problems due to inadequate supervision, lack of worker awareness, and insufficient use of personal protective equipment. Therefore, it is necessary to conduct a comprehensive risk analysis to evaluate the effectiveness of safety management systems implemented in construction projects.

Based on this background, this study aims to analyze Occupational Safety and Health risks in the construction project of the second floor of the Mabarrot Hasyimiyah NU Clinic located in Manyarejo, Manyar District, Gresik Regency. The results of this study are expected to contribute to improving safety management practices in construction projects and provide useful references for future research in construction risk management[5].

a. Risk

According to the Big Indonesian Dictionary (KBBI), risk is defined as an unpleasant (harmful, dangerous) consequence of an action or action. Risk is the prospect of an undesirable outcome (operationalized as a standard deviation)[5]. Risk is the magnitude of the deviation between the expected return (ER) and the actual return[3].

b. Occupational Safety and Health (K3)

Occupational Safety and Health (OHS) is a crucial aspect of the workplace, aimed at protecting workers from the risk of accidents and occupational diseases. In the construction industry, the implementation of OHS is crucial due to the complex, varied nature of the work, and the potential hazards involved. Construction projects, particularly high-rise buildings, are a sector with a relatively high occupational accident rate worldwide, including in Indonesia.

According to Law No. 1 of 1970 concerning Occupational Safety, every workplace is required to implement safety and health principles to create safe, comfortable, and healthy working conditions. Furthermore, Government Regulation No. 50 of 2012 concerning the Occupational.

Safety and Health Management System (SMK3) also emphasizes the importance of implementing a structured management system to control occupational risks.

The first stage in the risk management process is risk identification[2]. Risk identification is a systematic and continuous process carried out to identify the possibility of risks or losses to a company's assets, liabilities, and personnel. This risk identification process is perhaps the most important process, because it is through this process that all existing or potential risks in a project must be identified. The identification process must be carried out carefully and comprehensively, so that no risks are missed or unidentified[6].

2. Research Methods

2.1 Research Approach

This study employed a quantitative descriptive method to analyze Occupational Safety and Health (OSH) risks in construction projects. Quantitative approaches are commonly used to evaluate relationships between safety variables[1].

2.2 Research Location

The research was conducted at the construction site of the second floor of the Mabarrot Hasyimiyah NU Clinic located in Manyarejo Village, Manyar District, Gresik Regency, East Java, Indonesia. The project involves structural construction activities such as reinforcement installation, scaffolding work, formwork assembly, and concrete casting.

2.3 Data Collection Techniques

a. Field Observation

Field observation was conducted to directly observe construction activities and identify potential safety hazards within the project area. The use of questionnaires in construction safety studies is widely applied to assess risk perception[2]. Particular attention was given to high-risk activities such as work at heights, structural work, and equipment operation.

b. Interviews

Semi-structured interviews were conducted with key stakeholders involved in the project, including foremen, safety supervisors, and construction workers. The interviews aimed to gather information regarding safety practices, accident experiences, and risk perception among workers.

c. Questionnaire Survey

A questionnaire survey was used as the primary data collection instrument. The questionnaire was distributed to 50 respondents consisting of workers, foremen, and safety officers. Each questionnaire item was measured using a Likert scale ranging from 1 to 5.

2.4 Data Analysis Techniques

The collected data were analyzed using the following statistical methods:

a. Validity test using Pearson correlation
   Conducted to ensure that questionnaire items accurately measure the intended variables.
b. Reliability Test
   Conducted using Cronbach's Alpha to determine the consistency of the measurement instrument.
c. Mean Analysis
   Used to identify the average perception of respondents toward safety indicators.
d. Multiple Linear Regression Analysis
   Used to examine the influence of independent variables on the dependent variable.
e. Hypothesis Testing
   T-test and F-test were conducted to evaluate the partial and simultaneous effects of independent variables on the dependent variable.

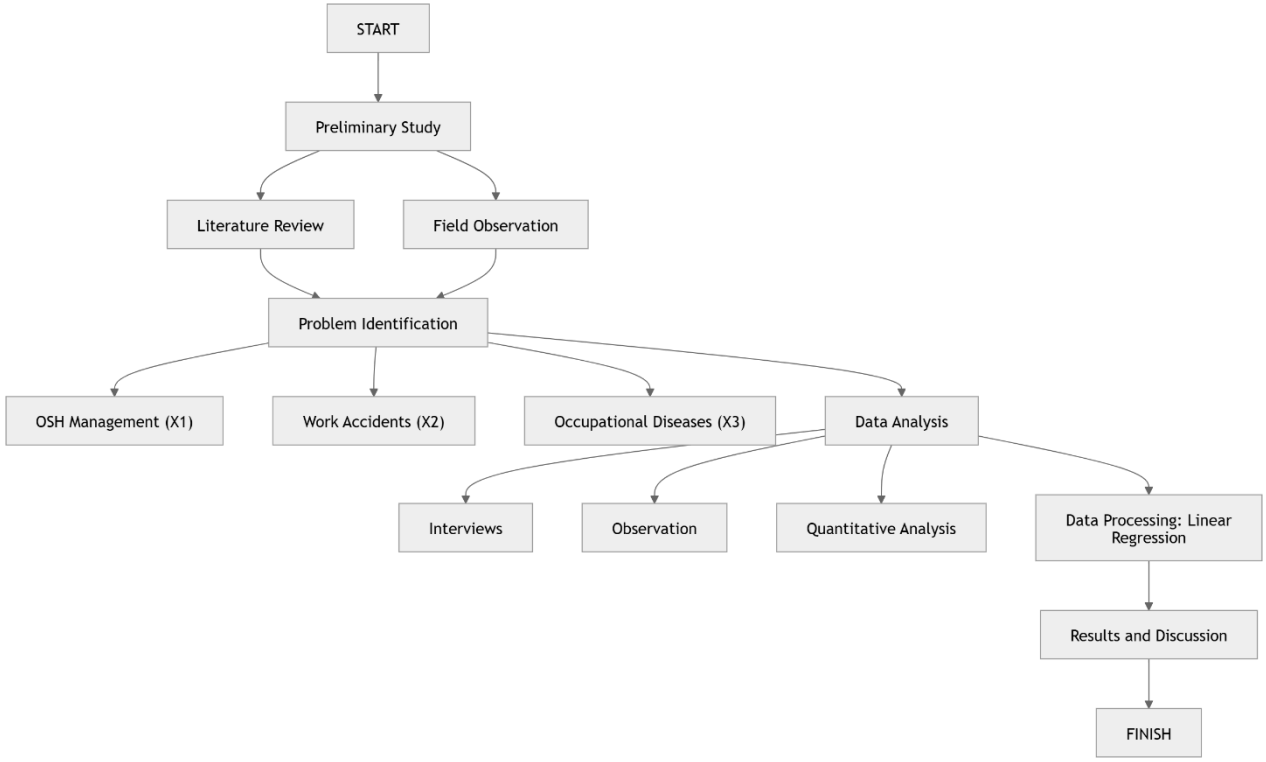

Figure 1. Flow Chart

3. Results and Discussion

Occupational Safety and Health (K3) in the second-floor construction project of the Mabarrot Hasyimiyah NU Manyar Clinic in Gresik. The analysis was conducted based on primary data obtained through questionnaires, field observations, and interviews with 50 respondents consisting of workers, foremen, and K3 supervisors. This distribution reflects the composition of the field workforce, with the majority of respondents being workers directly exposed to OHS risks. OHS supervisors and foremen, while smaller in number, provide important perspectives on OHS management and oversight.

3.1 Data Processing Results

Data processing was carried out after all distributed questionnaires were collected, and the results of the data processing can be seen in Appendix A. The data processing process in this study included questionnaire testing, including validity and reliability tests. Testing techniques. This aims to ensure whether the statement attributes in this study are valid and reliable. Data from the questionnaire has been input into the SPSS (Statistical Product and Services Solution) version 26 program.

3.2 Validity Test

Validity testing was conducted by analyzing the correlation between the scores for each statement and the total score. The survey statements were deemed effective in identifying the research objectives. All variables were declared valid and reliable with Cronbach's Alpha values greater than 0.6, indicating that the research instrument is consistent and suitable for analysis/ The efficacy of this study was statistically tested using IBM Statistical Product and Service Solution (SPSS) version 26 with a two-tailed test at a significance level of 0.05 (5%).

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Table 1. Validity Test

No	Indicators / Variables	r Count	r Table (0.2787) N-2 = 48	Information
Work Environment (X1)				
1.	X1.1	0.348	0.2787	VALID
	X1.2	0.400	0.2787	VALID
	X1.3	1.00	0.2787	VALID
	X1.4			VALID
	X1.5			VALID
2.	X2.1	0.358	0.2787	VALID
	X2.2	0.590	0.2787	VALID
	X2.3	0.547	0.2787	VALID
	X2.4			VALID
	X2.5			VALID
3.	X3.1	0.310	0.2787	VALID
	X3.2	0.307	0.2787	VALID
	X3.3	1.00	0.2787	VALID
	X3.4			VALID
	X3.5			VALID
6.	Y1.1	0.318	0.2787	VALID
	Y1.2	0.446	0.2787	VALID
	Y1.3	0.302	0.2787	VALID
	Y1.4			VALID
	Y1.5			VALID

Material Delay (X2)

Equipment (X3)

Delay in Work Implementation (Y)

3.3 Mean Value Analysis

The mean is the average value obtained by adding up all the data or scores from a variable, then dividing it by the number of data points. In research, especially those using Likert scales (such as the 1–5 scale), the mean is used to describe the general tendency or average perception of respondents towards a statement or indicator

Table 2. Mean Analysis

Monitoring	N	Minimum	Maximum	Mean	Std. Deviation	
Indicators for the Implementation of K3 (X1.4)	50	2	5	3.84	,912	
Effectiveness of OHS management in reducing risks (Y.5)	50	2	5	3.78	,887	
Periodic socialization/K3 training (X1.3)	50	1	5	3.64	,964	
Management support 50 for K3 implementation (X1.5)		2	5	3.62	,855	
Impact of risks on project time and cost (Y.4)	50	2.00	5.00	3,6000	,80812	
Availability and use of PPE (X1.2)	50	1	5	3.58	,883	
Availability of medical facilities at the project site (X3.3)	50	1	5	3.56	,972	
High and repetitive physical workload (X3.5)	50	2	5	3.54	,813	
Occupational air quality and ventilation (X3.4)	50	2	5	3.52	,886	
High risk of working at height (Y.3)	50	1	5	3.50	,953	
Working environment conditions are 50 at risk (X2.3)		1	5	3.46	,994	
Availability of clear K3 procedures 50 (X1.1)		1	5	3.44	1,053	
Identification of unaddressed hazards (Y.2)	50	1	5	3.42	,859	
Work time pressure triggers accidents (X2.5)	50	2	5	3.36	,964	
Lack of supervision as a trigger for accidents (X2.4)	50	1	5	3.34	1,002	
Perception of work risks in the project (Y.1)	50	1	5	3.32	,978	
Health problems due to the work environment (X3.1)	50	1	5	3.28	,927	
Exposure to hazardous materials (X3.2)	50	1	5	3.22	,887	
Have/are currently experiencing 50 minor accidents (X2.1)		1	5	3.20	,969	
History of serious accidents at the project site (X2.2)	50	1	5	3.08	1,027	
Valid N (listwise)	50					

The mean analysis in the Descriptive Statistics table aims to observe the average tendency of respondents' perceptions of each occupational safety and health (OHS) indicator in a project. Using a Likert scale of 1–5, the mean value reflects the respondent's level of agreement, with the higher the value, the more positive the assessment of that indicator. Based on the data, the indicators with the highest average are "Supervision of OHS implementation (X1.4)" at 3.84, and "Effectiveness of OHS management in reducing risk (Y.5)" at 3.78. This indicates that both aspects are considered to have been implemented well.

On the other hand, the lowest average values were found in the indicators "History of serious accidents at the project site (X2.2)" at 3.08 and "Exposure to hazardous materials (X3.2)" at 3.22, which indicates that there are problems that require special attention. Overall, a mean score above 3.5 indicates a positive perception from respondents, while a range of 3.0–3.5 indicates that the aspect is considered quite good but still requires improvement. Meanwhile, the standard deviation illustrates the extent of variation in answers between respondents; the higher the score, the greater the difference in opinion among them. This mean test serves as an initial analysis that helps identify which OHS indicators have been implemented effectively and which still require improvement. Furthermore, these results can be used to conduct further analyses such as t-tests, correlations, or regressions to further understand the relationships between variables. These findings are important for project management in determining priorities and strategies for improving OHS systems in the field.

3.4 Reliability Test

Reliability testing refers to understanding whether an instrument can measure something consistently over time. The reliability testing method used is the internal consistency method with Cronbach's alpha stability method using the reliability coefficient r. All variables were declared valid and reliable with Cronbach's Alpha values greater than 0.6, indicating that the research instrument is consistent and suitable for analysis (Sugiyono, 2016). Reliability testing is conducted on all questions simultaneously, and the test results are considered reliable if the Cronbach's alpha value is > 0.6. The results of the reliability test for each variable are processed using the IBM Statistical Product and Service Solution (SPSS) version 26 program.

Table 3. Reliabel Test

	Indicator/variable	Cronbach's alpha	Correlation coefficient	Information
	X1.1	(X1) 0.762	0.6	Reliable
	X2.1	(X2) 0.790	0.6	Reliable
	X3	(X3) 0.766	0.6	Reliable
	Y.1	(Y) 0.643	0.6	Reliable

Based on the validity and reliability test results shown in the table, all indicators for each variable are declared valid and reliable. The Cronbach's Alpha value for variable X1 is 0.762, X2 is 0.790, X3 is 0.766, and variable Y is 0.643. All of these values are above the minimum threshold of 0.60, indicating that the instrument used has good internal consistency. In addition, the correlation coefficient value for all indicators is 0.6, which means that each indicator has a fairly strong relationship with The total score of the variables. A correlation coefficient value exceeding 0.30 also indicates that the indicators are valid in measuring the intended variable construct. Thus, it can be concluded that all research instruments used have met the requirements for validity and reliability.

3.5 Multiple Linear Regression Test

Multiple Linear Regression Analysis is an analysis that connects two or more independent variables with a dependent variable with the aim of measuring how much influence each dependent variable has, either partially or simultaneously.

Table 4. Coeeficient Test

Coefficientsa

		Unstandardized		Standardized		
Mod		Coefficients B Std. Error		Coefficients Beta	t	Sig.
1	(Constant)	1,108	,642		1,726	,091
	K3 management	,264	,123	,284	2,152	,037
	of work accidents,	,281	,159	,278	1,772	,083
	diseases caused by	,123	,167	,117	,736	,465

Based on the results of multiple linear regression analysis displayed in the Coefficients table, it is known that the independent variables consisting of OHS management, work accidents, and diseases due to OHS have different influences on the dependent variable, namely the potential risk due to OHS. The constant value of 1.108 with a significance of 0.091 indicates that when all independent variables are zero, the potential risk due to OHS is estimated at 1.108, although it is not statistically significant ($p > 0.05$). The OSH management variable has a coefficient value of 0.264 with a significance of 0.037, which means that OSH management has a positive and significant effect on potential risks due to OSH. This means that the better OSH management is carried out, the potential risks due to OSH can increase in this context (for example, due to more accurate reporting or expectations of increased risk awareness). The work accident variable has a coefficient of 0.281 with a significance value of 0.083. Although it has a positive effect, the effect is not statistically significant ($p > 0.05$), so it cannot be concluded that work accidents directly affect potential

risks due to OSH at the 95% confidence level. Meanwhile, the OSH-related disease variable has a coefficient value of 0.123 and a significance value of 0.465, which indicates that this variable does not have a significant effect on potential risks due to OSH.

Thus, of the three independent variables tested, only K3 management was proven to have a significant influence on the potential risks due to K3 in this regression model.

3.6 T-test

The T-test is used to test the hypothesis of the influence of individual independent variables on the dependent variable. It is known that N = 50 with a significance level of 0.05 (5%) and is explained by the T-table result of 2.009.

Table 5. T Test

Coefficientsa

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	,642	1.108		1,726	,091
	K3 management	,264	,123	,284	2,152	,037
	of work accidents,	,281	,159	,278	1,772	,083
	diseases caused by	,123	,167	,117	,736	,465

K3 a. Dependent Variable: potential risk due to K3
Source: 2025 Data Processing

T-test conclusion

From the t-test results, only the OHS management variable had a statistically significant influence on the potential risks due to OHS. The other two variables, namely work accidents and OHS-related illnesses, did not show a significant partial influence on the dependent variable.

3.7 F test

The F test is conducted to see the influence of independent variables on dependent variables simultaneously. The method used is to look at the level of significance (=0.05). If the significance value is less than 0.05, then H0 is rejected and Ha is accepted.

Table 6. T Test

ANOVA

Model		Sum of Squares	df	Mean Square 3 1.202	F	Sig.
1	Regression	3.606			1,232	.318b
	Residual	25,361	26	.975		
	Total	28,967	29			

a. Dependent Variable: Potential K3 risk
b. Predictors: (Constant), Workers due to work, K3 Management, Work accidents

Based on the results of the ANOVA test in the table, it is known that the calculated F value is 1.232 with a significance value (Sig.) of 0.318. This F test is used to determine the effect of independent variables simultaneously (together) on the dependent variable, namely the potential for OHS risks. The independent variables used in this model are K3 management, work accidents, and occupational diseases. In statistical testing, if the significance value is <0.05, then the regression model is considered imultaneously significant, meaning that all independent variables simultaneously influence the dependent variable. However, in this result, the significance value of 0.318 is >0.05, indicating that the regression model is not simultaneously significant.

This means that occupational health and safety management, workplace accidents, and occupational diseases collectively do not significantly influence potential occupational health and safety risks. Although one variable (occupational health and safety management) was previously shown to have a partial effect in the t-test, the overall model is not strong enough to explain the variations in potential occupational health and safety risks.

4. Conclusions

The results of an analysis of potential Occupational Safety and Health (K3) risks in the second-floor construction project of the Mabarrot Hasyimiyah NU Manyar Clinic, Gresik. The analysis was conducted based on primary data obtained

through questionnaires, field observations, and interviews with 50 respondents consisting of workers, foremen, and K3 supervisors. OSH risks still exist in construction activities, particularly in high-risk environments such as structural work. OSH management has been identified as the most dominant factor influencing safety performance. Therefore, improving supervision, enforcing safety procedures, and ensuring proper use of Personal Protective Equipment (PPE) are essential to reduce risks in construction projects. Based on the results of data analysis and discussion, the following conclusions can be drawn:

a. Various potential Occupational Safety and Health (OHS) risks were found in the second floor construction project of the Mabarrot Hasyimiyah NU Manyar Clinic, Gresik. These risks include the suboptimal use of personal protective equipment (PPE), work at dangerous heights, time pressure that can trigger work accidents, exposure to hazardous materials, weak supervision of the implementation of safety procedures, and the lack of adequate medical facilities at the activity location. This risk identification was obtained from the results of data collection through the distribution of questionnaires, direct observations in the field, and interviews with workers and OHS supervisors. These findings indicate that several OHS aspects in this project still need attention and improvement to create a safer and more controlled work environment.
b. The risk level of each potential hazard is analyzed using a quantitative approach through multiple linear regression, T test, F test, and average value analysis. Based on the analysis results, it is known that of the three independent variables tested, only K3 management (X1) was proven to have a significant influence on potential K3 risks (Y). These findings confirm that the implementation of an effective OHS management system plays a significant role in reducing the risk of occupational accidents in construction projects. Meanwhile, the variables of occupational accidents (X2) and occupational diseases (X3) did not show a statistically significant relationship to potential risks, although in practice both factors still require special attention. The simultaneous F-test also showed that overall, the three independent variables did not have a significant influence on OHS risks, indicating the possible influence of other variables outside the model used in this study. In addition, the results of the analysis of the average values showed that the indicators that received the highest responses from respondents were supervision of OHS implementation and the effectiveness of the OHS management system, while the indicators with the lowest values were a history of serious accidents and exposure to hazardous materials. Based on these overall results, it can be concluded that optimal OHS management is the most important element in efforts to reduce occupational risks in construction projects, although other aspects should not be ignored.

5. Declarations

5.1. Author Contributions

Conceptualization, M.H.K. and D.J.P.; methodology, P.A.P.S.; software, M.H.K.; validation, M.H.K., D.J.P., and A.A.F.; formal analysis, M.H.K.; investigation, P.A.P.S.; resources, P.A.P.S.; data curation, M.H.K.; writing—original draft preparation, D.J.P.; writing—review and editing, A.A.F.; visualization, A.A.F.; supervision, P.A.P.S.; project administration, P.A.P.S. All authors have read and agreed to the published version of the manuscript.

5.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author:

5.3. Funding

Funding information is not available:

5.4. Acknowledgements

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5.5. Conflicts of Interest

The authors declare no conflict of interest:

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