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# Evaluation of the Occupational Health and Safety (K3) Management System in the Construction Project of the Campus Building of Pamulang University

**Agung Suciyanto[1], Deva Robbie Willian[2], Rafqi Danial Farabi[3], Awliya Tribhuana[4]**
Universitas Swadaya Gunung Jati, Indonesia
Email: agungsuciyanto61@gmail.com

**ABSTRACT**
The construction industry has a high level of occupational accident risk, making the implementation of an Occupational Safety and Health Management System (OSHMS) essential in construction projects. This study aims to evaluate the implementation of OSHMS in the construction project of the Pamulang University Campus Building and to identify potential hazards, risk levels, and risk control measures applied on site. This research employed a quantitative descriptive method, collecting data through field observations, interviews, and questionnaires distributed to 55 respondents directly involved in the project. Data analysis was conducted using SPSS to test the validity and reliability of the questionnaire, while the HIRARC method was used for hazard identification, risk assessment, and risk control. The results indicate that all questionnaire items were valid and reliable, with Cronbach's Alpha values of 0.842 for the likelihood variable and 0.818 for the severity variable. The evaluation of OSHMS implementation achieved an average score of 4.07, categorized as good. The highest risk was identified in upper structural work, particularly the hazard of falling from height. It can be concluded that the implementation of OSHMS in the project has been carried out effectively; however, improvements in supervision and worker compliance are still required to further reduce occupational accident risks.

**Keywords:** Occupational Safety and Health (OHS), OHSMS, HIRARC, Construction Projects, Campus Buildings

## INTRODUCTION

The construction industry is one of the sectors with a high level of occupational accident risk due to its work characteristics, which involve activities at heights, the use of heavy equipment, and dynamic working environment conditions. Globally, the construction sector remains a significant contributor to workplace accidents, with the main causes being falls from heights, being struck by materials, and accidents resulting from the use of unsafe work equipment (International Labour Organization [ILO], 2019; ILO, 2021). Therefore, the systematic and sustainable implementation of occupational safety and health (K3) is a vital requirement in every construction project (Bourahla et al. 2024; Kineber et al. 2023; Supriyatna et al. 2020).

The implementation of an Occupational Safety and Health Management System (SMK3) has been proven to play an important role in improving project performance while reducing the rate of workplace accidents (EL-Matury et al. 2025; Forteza et al. 2017; Pratama et al. 2021; Qazi et al. 2016; Sampe et al. 2025). Research shows that construction projects that consistently implement a K3 management system record lower accident rates and higher work productivity than projects that implement K3 only administratively (Lingard & Wakefield, 2017; Zhou et al., 2018). However, the effectiveness of SMK3 implementation strongly depends on

management commitment, worker compliance, and the level of supervision of K3 implementation in the field (Heronasia et al. 2025; Hulu et al. 2025; Nasution 2024; Sinaga 2025; Wulandari et al. 2024).

In Indonesia, the implementation of SMK3 is regulated under Government Regulation of the Republic of Indonesia Number 50 of 2012, which requires companies to manage occupational safety and health in a structured manner. Nevertheless, various studies indicate that the implementation of K3 in construction projects still faces a number of challenges, particularly those related to unsafe work behavior, lack of optimal supervision, and a weak safety culture (Sari et al., 2020; Wicaksono & Pratama, 2021).

Campus building construction projects have a high level of complexity and risk because they involve multiple types of construction work within a single site (Forteza et al. 2017; Qazi et al. 2016). These risks necessitate the systematic implementation of K3 risk management through hazard identification, risk assessment, and risk control. The HIRARC method is considered effective for identifying and controlling potential hazards in building construction projects (Hallowell & Gambatese, 2016; Gambatese et al., 2017). However, empirical studies specifically evaluating the application of SMK3 in campus building construction projects in Indonesia remain limited.

The urgency of this research is underscored by several factors. First, the construction of educational facilities, including university campus buildings, involves unique risks due to the presence of students, faculty, and staff in adjacent areas during construction, requiring enhanced safety measures. Second, the Pamulang University Campus Building construction project represents a significant investment in educational infrastructure, and ensuring worker safety during construction is both a legal requirement and a moral obligation. Third, the findings from this research can provide valuable insights for improving OSH implementation in similar educational construction projects across Indonesia. Fourth, as the government continues to invest in educational infrastructure development, evidence-based recommendations for enhancing construction safety are essential for both worker protection and project success.

The novelty of this research lies in several aspects. First, it provides a comprehensive evaluation of SMK3 implementation in an educational building construction project in Indonesia by combining questionnaire-based assessment with HIRARC analysis. Second, it specifically examines the application of Government Regulation Number 50 of 2012 requirements in a real-world construction context, providing empirical evidence on regulatory compliance. Third, it identifies specific high-risk activities in campus building construction and evaluates the effectiveness of the implemented risk control measures. Fourth, it offers practical recommendations for improving OSH implementation based on systematic data collection and analysis. Fifth, it contributes to the limited body of knowledge on construction safety in educational facilities within developing countries.

Therefore, this study aims to evaluate the application of the Occupational Safety and Health Management System (SMK3) in the construction project of the Pamulang University Campus Building to determine the level of effectiveness of its implementation and identify aspects that need improvement to minimize the risk of workplace accidents.

## RESEARCH METHODS

This study uses a qualitative-quantitative approach by collecting primary and secondary data through observations, interviews, and questionnaires (Jayusman & Shavab, 2020).

This study uses both quantitative and descriptive approaches to assess the application of the Occupational Safety and Health Management System (SMK3) in the construction project of the Pamulang University Campus Building. The quantitative approach collects numerical data to objectively measure the level of implementation of SMK3, while the descriptive method shows the actual conditions of SMK3 implementation in the field without considering the research variables.

The focus of the research is how to use the K3 management system in campus building construction projects. Project workers and other related parties were the subjects of the study. Field observations, brief interviews, and distribution of questionnaires to 55 selected people are considered common procedures for the application of K3 in research projects. This method is used to collect data. Secondary data comes from relevant K3 reports, project documents, literature, and regulations.

The research tool is a closed questionnaire with a five-level Likert scale consisting of two questions prepared based on SMK3 elements, namely K3 policies and commitments, K3 planning, implementation and operations, monitoring and evaluation of K3 performance, improvement and prevention actions, and the effectiveness of K3 implementation. The data obtained was analyzed with the IBM SPSS program. Descriptive analysis based on mean values and assessment categories was carried out to determine the level of K3 implementation, and the validity and reliability of research instruments were tested.

In addition to questionnaire analysis, this study also uses the HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method to identify potential hazards in construction activities, assess the level of risk based on the likelihood and intensity of impacts, and determine appropriate risk control measures. Risk assessments were included in the low, medium, and high categories using a 3×3 risk matrix. The results of the analysis are presented in the form of tables and descriptive narratives to provide a complete picture of the implementation of SMK3 and occupational safety risks in research projects.

The location of this research is on Jl. Rajawali G No.33, Pamulang Bar., Pamulang District, South Tanggerang City, Banten 1547.


**Results of Analysis and Data Processing of Questionnaires**

Based on the results of data analysis and processing, several aspects are found that are considered the most important, namely:

Results of the Probability Validity Test (Likelihood)

Risk Assessment ( Penilaian Resiko)

Risk Control ( Pengendalian Resiko)

Implications of the Implementation of K3 on Occupational Safety

After that, it is explained about some of the aspects above and described as follows:

**Results of the Probability Validity Test (Likelihood)**

In accordance with the provisions of the degree of freedom, or DF, with the formula (df = N - 2, 0.05). Where the value of N is the sample size or number of participants. The probability assessment results of the questionnaire questions were conducted using IBM's SPSS analysis, which resulted in an average value of r Count greater than r Table. The validity test of each questionnaire item is shown in the following table.

**Table 1. Validity Test Results**

| VALIDITY TEST | | | |
|---|---|---|---|
| ITEM | rCOUNT | rTABLE | RESULTS |
| X1 | 0.648 | 0.266 | Valid |
| X2 | 0.637 | 0.266 | Valid |
| X3 | 0.652 | 0.266 | Valid |
| X4 | 0.711 | 0.266 | Valid |
| X5 | 0.527 | 0.266 | Valid |
| X6 | 0.589 | 0.266 | Valid |
| X7 | 0.673 | 0.266 | Valid |
| X8 | 0.443 | 0.266 | Valid |

| | | | |
|---|---|---|---|
| X9 | 0.615 | 0.266 | Valid |
| X10 | 0.630 | 0.266 | Valid |
| X11 | 0.654 | 0.266 | Valid |
| X12 | 0.561 | 0.266 | Valid |
| X13 | 0.554 | 0.266 | Valid |
| X14 | 0.603 | 0.266 | Valid |
| X15 | 0.758 | 0.266 | Valid |
| X16 | 0.662 | 0.266 | Valid |
| X17 | 0.670 | 0.266 | Valid |
| X18 | 0.739 | 0.266 | Valid |
| X19 | 0.615 | 0.266 | Valid |
| X20 | 0.765 | 0.266 | Valid |
| X21 | 0.618 | 0.266 | Valid |
| X22 | 0.601 | 0.266 | Valid |

The results of the study show that the questionnaire instrument used in this study meets the eligibility criteria as a measuring tool. Validity tests involving the likelihood and severity variables are declared valid for each item. The results showed that the item was valid as a whole, as the r-calculated value was greater than the r-table value (0.266). In addition, the reliability test using Cronbach's Alpha method yielded values of 0.842 for the probability variable and 0.818 for the severity variable, indicating that there is a high level of reliability. As a result, the questionnaire data is reliable and can be used for additional analysis.

Risk Assessment ( Penilaian Resiko)

To assess risk, the value of the likelihood of harm (likelihood) is multiplied by the severity of the consequences caused. The results of the assessment showed that the work of the upper structure with the potential danger of falling from a height, which is 20, was included in the high risk category due to the high severity of the accident and the higher likelihood of incident.

**Table 2. Results of occupational risk assessment of superstructure, Material Handling, and wet work areas**

| Work Activities | Potential Hazards | Likelihood | Severity | Risk Value | Risk Categories |
|---|---|---|---|---|---|
| Structure Work | Falling from a height | 4 | 5 | 20 | Height |
| Material Handling | Overwhelmed by material | 3 | 4 | 12 | Medium |
| Wet work area | Slipped | 2 | 3 | 6 | Low |

The results of the assessment show that the work of the upper structure with the potential danger of falling from a height, which is 20, is included in the high risk category, due to the high severity of the accident and the greater likelihood of incidents.

**Risk Control**

The results of risk control determine how to address risk. Elimination, substitution, technical control, administrative control, and use of personal protective equipment (PPE) are part of the risk control system.

**Table 3. Results of risk control in various work activities**

| Yes | Work Activities | Potential hazards | Likelihood (L) | Severity (S) | Risk Value (LxS) | Risk Categories | Risk Control |
|---|---|---|---|---|---|---|---|
| 1 | Upper Structure Work | Falling from a height | 4 | 5 | 20 | Height | Installation of safety railings, safety nets, full body harness use |
| 2 | Material Transportation | Overwritten by Material | 3 | 4 | 12 | Medium | Safe material arrangement, work area restrictions, use of safety helmets |
| 3 | Casting Work | Slipped | 3 | 4 | 9 | Medium | Cleaning work area,anti-sliffing mats,reminder signs |
| 4 | Welding | Sparks | 2 | 4 | 8 | Medium | Complete use of PPE, fire extinguisher face protection available |
| 5 | Use of heavy equipment | Hit by heavy equipment | 2 | 5 | 10 | Medium | Heavy equipment line setting,certified operator,field supervisor |
| 6 | Iron cutting | Hit by sharp objects | 3 | 2 | 6 | Low | Work gloves, SOP cutting, worker training |
| 7 | Dusty work area | Dust exposure | 3 | 2 | 6 | Low | Mask, watering dusty areas |
| 8 | Electrical work | Electric shock | 2 | 4 | 8 | Medium | Cable insulation, agency inspection, electrical PPE |

Based on the results of the risk assessment, risk control is carried out with reference to the hierarchy of K3 control. For high risks, such as falling from height, control is focused on technical and administrative controls, such as installing safety fences, safety nets, and ensuring the use of full body harnesses. In addition, to ensure that control runs well, regular supervision and inspections are carried out.

**Implications of the Implementation of K3 on Occupational Safety**

To create a safe, healthy, and productive work environment, the implementation of a planned and sustainable occupational safety management system is essential. Efforts to improve the implementation of K3 must be carried out consistently through training, supervision, and periodic evaluation.

**Table 4 Smk3 implementation evaluation results based on indicators**

| Yes | K3 Implementation Indicators | Item Code | Red | Categories |
|---|---|---|---|---|
| 1 | K3 Policies and Commitments | P1–P4 | 4,1 | Good |
| 2 | K3 Planning | P5–P7 | 4,08 | Good |
| 3 | Implementation and Operations | P8–P11 | 4,12 | Good |
| 4 | K3 Performance Monitoring and Evaluation | P12–P14 | 4,07 | Good |
| 5 | Corrective and Preventive Measures | P15–P17 | 4 | Good |
| 6 | Effectiveness of K3 Implementation | P18–P22 | 4,06 | Good |
| — | Overall Average | — | 4,07 | Good |

The results of the questionnaire analysis showed that overall, the level of implementation of the Occupational Safety and Health Management System (SMK3) in the construction project of the Pamulang University Campus Building was categorized as good, with an overall average score of 4.07. Each SMK3 implementation indicator includes SMK3 policies and commitments, SMK3 planning, implementation and operations, SMK3 performance monitoring and evaluation, corrective and preventive actions, and effectiveness.

The findings indicate that the level of SMK3 implementation in the construction project of the Pamulang University Campus Building is in the good category, with an overall average score of 4.07. This achievement demonstrates that K3 policies, planning, implementation, and monitoring have been systematically applied in the field. Such progress results from project management's commitment to providing work procedures, personal protective equipment, and consistent supervision mechanisms. These findings align with those of Lingard and Wakefield (2017), who stated that management commitment is the main factor determining the successful implementation of occupational safety systems in construction projects.

Nevertheless, the results of the risk analysis using the HIRARC method show that upper-structure work has the highest level of risk, particularly the hazard of falling from height. This risk remains high even when SMK3 has been implemented, as work at height inherently involves a high degree of impact severity and a relatively high probability of accidents. These findings are consistent with the research of Hallowell and Gambatese (2016) and Gambatese et al. (2017), who stated that work at height is the primary cause of fatal accidents in construction projects and requires stricter technical and administrative controls.

Compared with the studies of Sari et al. (2020) and Wicaksono and Pratama (2021), the SMK3 implementation value in this project is relatively higher. This difference may be attributed to the existence of a more structured field supervision system and the implementation of risk controls in accordance with the K3 hierarchy, such as the use of safety nets, full-body

harnesses, and regulated heavy equipment work paths. However, similar to the findings of Zhou et al. (2018), this study also shows that unsafe behavior and dependence on personal protective equipment remain the main challenges in effectively reducing accident risks.

Scientifically, the results of this study reinforce the concept that strong implementation of SMK3 does not necessarily eliminate high risks completely, especially in hazardous construction activities. The scientific implication underscores the need for integration between the K3 management system, safety behavior approach, and safety culture development. Thus, this study provides an empirical contribution to the advancement of SMK3 research in educational building construction projects and can serve as a reference for improving work accident risk control strategies in the future.

## CONCLUSION

Based on the results of the research and discussion, it can be concluded that the implementation of the Occupational Safety and Health Management System (SMK3) in the construction project of the Pamulang University Campus Building falls into the good category, with an average implementation score of 4.07. This achievement indicates that K3 policies, planning, implementation, and monitoring have been systematically applied and supported by strong project management commitment.

However, the results of the HIRARC analysis show that upper-structure work still presents the highest level of risk, particularly the hazard of falling from height. This condition arises due to the high severity of accident impacts and the inherently risky nature of such work, meaning that even well-implemented SMK3 measures cannot completely eliminate these hazards. Therefore, risk control in high-risk activities should focus on stricter technical and administrative measures, accompanied by continuous field supervision.

Scientifically, this study confirms that the success of SMK3 implementation is determined not only by the completeness of systems and procedures but also by consistent supervision and worker behavioral compliance. This research provides an empirical contribution to the development of SMK3 studies in educational building construction projects and can serve as a reference for improving occupational safety strategies to minimize accident risks in similar construction contexts.

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