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Determinants of Occupational Health and Safety Compliance in Construction Project: Evidence from Indonesia

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ABSTRACT

Occupational Health and Safety (OHS) initiatives aim to ensure a safe working environment by protecting workers from occupational hazards. However, the implementation of OHS in Indonesia's construction sector remains inconsistent, with the Social Security Agency for Employment reporting 347,855 workplace accidents in 2023. This study assesses the level of OHS compliance and identifies key determinants influencing effective implementation on construction projects. A descriptive quantitative approach was employed, using primary data from 71 respondents, including contractors, supervisory consultants, and laborers, as well as secondary data from project documentation. Five factors were examined: OHS management, knowledge and training, implementation practices, personal protective equipment (PPE), and supervision. Validity and reliability tests confirmed data accuracy, with Cronbach's alpha values exceeding 0.6. Descriptive statistics yielded an average score of 4.34, indicating general satisfaction with current practices. Multiple linear regression analysis revealed that all five factors positively influenced OHS compliance, with PPE, implementation practices, and OHS management showing statistically significant impacts. In contrast, knowledge and training, as well as supervision, were not statistically significant. The model demonstrated strong explanatory power, with an R^2 of 71.4%. These findings suggest that OHS practices at the UIN Ar-Raniry Banda Aceh integrated lecture building project are generally effective. The results emphasize the need to prioritize PPE availability and strengthen OHS management to mitigate risks in Indonesian construction projects.

Keywords— *construction project; occupational health and safety; personal protective equipment*

I. INTRODUCTION

The rapid expansion of the construction sector has made Occupational Health and Safety (OHS) increasingly essential for creating safe working environments and protecting workers from occupational hazards [1-3]. Despite the critical importance of OHS, its implementation in construction projects is often inadequate, evidenced by Indonesia's alarming construction-related accident rate, with recent data reporting 347,855 cases [4]. The Occupational Health and Safety Management System (OHSMS) was established to mitigate such risks, addressing potential material losses, productivity disruptions, and threats to worker safety and environmental stability [2, 5, 6].

Construction activities, ranging from building construction to roadwork and bridge projects, operate under intense time and budget constraints, which can compromise safety practices [7, 8]. OHS serves as a proactive safeguard, aiming to reduce incidents of work-related accidents and occupational illnesses through the integration of safety and health protocols [9-12]. The ultimate goal of OHS initiatives is to promote a "zero accident" culture nationwide, supported by policies designed to prevent workplace injuries, accidents, and health complications arising from work conditions [13-17].

A comprehensive approach to occupational safety includes protective measures to guard workers against injuries and job-related incidents by assessing risks, providing training, enforcing personal protective equipment (PPE) usage, and continuously monitoring working conditions [18]. Effective OHS implementation in construction projects not only fosters a safer work environment and reduces accidents but also enhances productivity and regulatory compliance [1, 5, 7, 11]. As a structured

framework, an OHS program provides a blueprint for implementing safety standards and controlling workplace risks [19].

The success of OHS initiatives in construction projects is influenced by multiple factors, including five core elements: OHS management, worker knowledge and training, practical OHS application, availability and usage of PPE, and consistent OHS supervision [20, 21]. PPE, such as helmets, safety footwear, gloves, goggles, ear protection, masks, and face shields, is fundamental in minimizing injury severity and preventing accidents in construction settings [22, 23]. Additionally, factors influencing PPE utilization, such as worker awareness and enforcement policies, significantly affect OHS implementation outcomes on construction sites [24]. Alongside PPE, Workplace Safety Equipment (WSE), which encompasses fixed devices designed to protect workers from hazards, plays an essential role in sustaining a safe and healthy work environment. Together, PPE and WSE are integral to a comprehensive OHS management system [23, 25].

This study aims to evaluate the implementation of OHS practices within construction projects and identify the determinants that influence OHS compliance. Specifically, this research seeks to assess current OHS practices and analyze the factors that impact their effectiveness in safeguarding workers' health and safety in the construction sector.

II. Material and Method

This study employs a quantitative research approach to provide a thorough analysis of Occupational Health and Safety (OHS) factors in construction projects [26]. The Saturation Sampling technique is applied, involving all members of the population as determined by the study's objectives [27]. Data collection comprises both primary and secondary sources [28]. Primary data are obtained via questionnaires distributed to relevant stakeholders, while secondary data, including project profiles, support the analysis by providing contextual insights.

The study is conducted in Banda Aceh at the construction site of the Integrated Lecture Building at Ar-Raniry State Islamic University. This building is a three-story structure with a total area of 1,088 m².

The study population includes 90 individuals, comprising supervisory consultants, contractors, and laborers involved in the construction project. Utilizing the Saturation Sampling method, the research encompasses the entire population to ensure comprehensive data coverage aligned with the research objectives [27].

Data collection includes both primary and secondary data. Primary data are gathered by distributing questionnaires to the respondents, while secondary data, such as project profiles, provide additional background for the analysis. The data processing involves evaluating five key factors: OHS management (X1), knowledge and training (X2), OHS implementation (X3), personal protective equipment (PPE) (X4), and OHS supervision (X5).

Instrument testing for reliability and validity is conducted to ensure data accuracy [29]. Validity testing requires that each variable's calculated r-value exceeds the r-table value, confirming that the instrument measures the intended factors. Reliability testing involves calculating Cronbach's alpha for each variable, with a threshold of 0.6 indicating acceptable internal consistency [30]. These steps verify the accuracy and consistency of the instrument used in this study.

Data analysis involves both descriptive and inferential statistical methods. Descriptive statistics are used to summarize the characteristics of the respondent sample and to assess general trends in responses to survey items [31]. This analysis provides insight into the distribution of responses and helps to describe the overall sentiment regarding OHS factors.

To understand the collective influence of independent variables on the dependent variable (OHS implementation), multiple linear regression analysis is applied. This model assesses the degree to which each independent variable (e.g., OHS management, PPE usage) contributes to OHS implementation.

Correlation analysis examines the strength and direction of relationships between pairs of variables. This analysis helps identify the extent to which the independent factors are associated with OHS implementation, highlighting the strongest predictors of OHS compliance within the project.

These analytical methods provide a robust framework for evaluating the determinants of OHS compliance in construction projects, enabling data-driven conclusions and recommendations for enhancing safety practices.

III. Result and Discussion

A. Respondent Characteristics

The respondent demographic profile is outlined in Figure 1, revealing key characteristics across gender, age, education, and position categories.

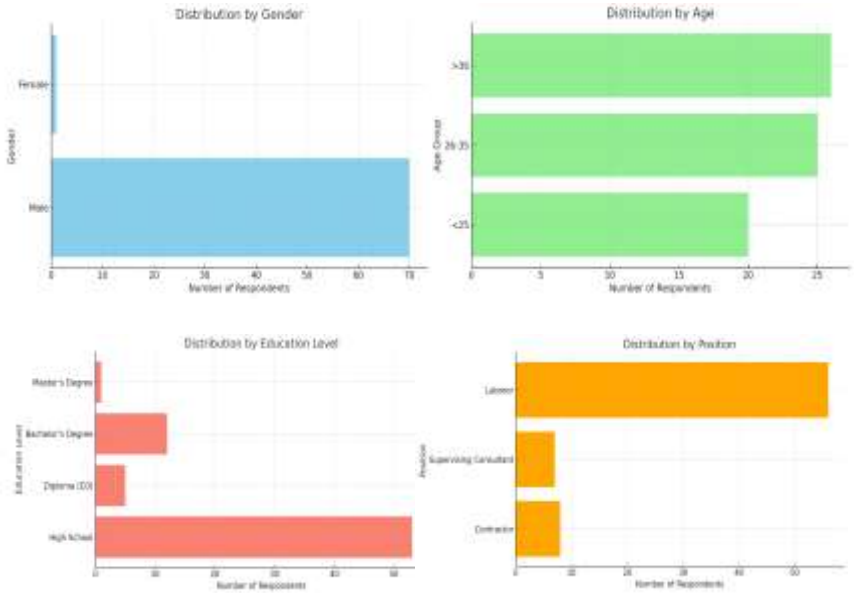

Fig. 1. Demoghraphics of respondent

The survey respondents are predominantly male (98.59%) and reflect a population mainly composed of young to middle-aged individuals with high school-level education and primarily working as laborers on-site. This demographic overview may influence the study results and interpretations, particularly in understanding the perspectives and experiences of field workers regarding OHS practices.

B. Validity and Reliability Test

The validity test establishes that each variable's Pearson product moment correlation value exceeds the r-table value of 0.233 (significance level < 0.05), confirming the validity of all question items.

TABLE I. VALIDITY AND RELIABILITY TEST

Variable		r-calculated	Cronbach's Alpha	Reliability
X1	OHS management	0.756	0.812	Highly reliable
X2	Knowledge and training	0.678	0.699	Reliable
X3	OHS implementation	0.575	0.714	Reliable
X4	Personal protective equipment	0.752	0.814	Highly reliable
X5	OHS supervision	0.707	0.824	Highly reliable
Y	OHS implementation outcome	0.624	0.766	Reliable

The reliability test, evaluated through Cronbach's alpha, confirms that all variables have reliability values above the threshold of 0.6, with several variables scoring above 0.8, indicating high reliability.

C. Descriptive Analysis

The descriptive analysis highlights the general response distribution for each variable, showing that mean values exceed standard deviations, indicating low dispersion and consistency across respondent feedback.

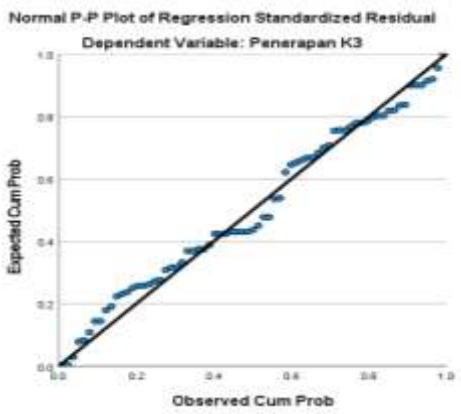

Fig. 2. Normality test plot

From the figure above, it can be observed that the distribution of data points follows the direction of the diagonal line. Therefore, it can be concluded that the data is normally distributed, and the normality assumption is not violated.

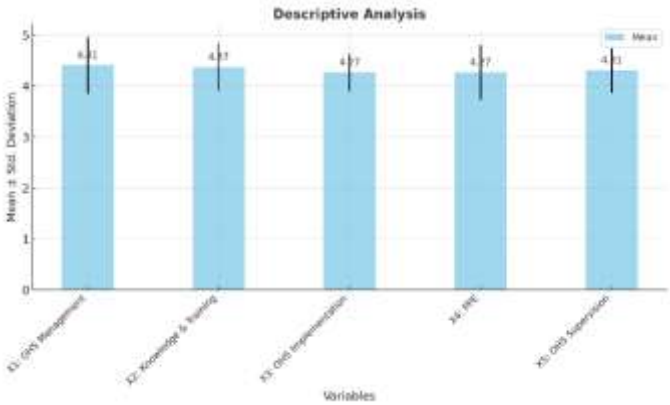

Fig. 3. Descriptive analysis

Based on the information provided, it indicates that N or the number of respondents is known to be 71 respondents. For the OHS management variable (X1), the minimum value is 2, the maximum value is 5, the mean value is 4.41, and the standard deviation is 0.551. This means that the mean value of X1 is greater than the standard deviation, indicating that the data dispersion is low and the values are evenly distributed.

D. Multiple Linear Regression Analysis

Multiple linear regression results indicate that the OHS management, implementation, and PPE factors significantly impact OHS outcomes. The regression model is as follows: Y = 4,063 + 0,249X1 + 0,138X2 + 0,225X3 + 0,522X4 + 0,128X5.

TABLE II. MULTIPLE LINEAR REGRESSION ANALYSIS

Variable	B	t-value	Sig.
Constant	4.063	1.497	0.139
X1	0.249	2.428	0.018
X2	0.138	1.037	0.304
X3	0.225	2.754	0.008
X4	0.522	4.860	0.000

X5	0.128	1.268	0.209

Partial test (t-test) aims to determine whether the independent variables have a significant effect on the dependent variable individually (partially). The t-Test is conducted by comparing the calculated t-value with the t-tabel. The t-Test reveals that OHS management (X1), OHS implementation (X3), and PPE (X4) have significant partial effects on OHS outcomes.

Simultaneous test (F-test) aims to determine whether the independent variables X1 to X5 have a simultaneous effect on the dependent variable regarding the implementation of OHS. The F-table value is determined using a significance level of 5%.

TABLE III. F-TEST

Model	Sum of squares	df	Mean square	F	Sig.
Regression residual total	442,656	5	88,531	32.464	0.000
	177,259	65	2,727		
	619,915	70			

The F-test shows a significant collective effect of all independent variables on OHS outcomes, with an F-value of 32.464 ($p < 0.05$).

The coefficient of determination test is conducted to measure and predict the extent of the contribution or influence given by the independent variables collectively on the dependent variable. The R^2 value of 0.714 indicates that 71.4% of the variation in OHS implementation is explained by the independent variables, while 28.6% is attributed to other factors.

E. Correlation Analysis

Correlation is expressed in numerical values that indicate the strength of the relationship between two or more variables. The purpose of conducting a correlation analysis is to assess the degree of closeness in the relationship between two or more variables.

TABLE IV. CORRELATION ANALYSIS

Variable	Y	Sig.	Strength of relationship
X1	0.420	0.000	Moderate
X2	0.521	0.000	Moderate
X3	0.603	0.000	Strong
X4	0.718	0.000	Strong
X5	0.679	0.000	Strong

The correlation analysis shows moderate to strong relationships between the independent variables and OHS implementation, with PPE (X4), OHS implementation (X3), and supervision (X5) exhibiting strong correlations.

F. Discussion

The analysis indicates that the level of Occupational Health and Safety (OHS) implementation, in the construction project is robust. The descriptive statistics reveal an average respondent score of 4.34, suggesting high satisfaction with OHS practices, and the coefficient of determination (R^2) from the determinant test shows that 71.4% of the variation in OHS implementation is explained by the studied factors. This high explanatory power points to the substantial role these variables play in influencing OHS adherence and outcomes on the project site.

Among the factors analyzed, three were found to be particularly influential according to the t-test: Personal Protective Equipment (PPE) (X4), OHS Implementation (X3), and OHS Management (X1). In contrast, Knowledge and Training (X2) and OHS Supervision (X5) did not demonstrate statistically significant effects on OHS compliance. This outcome implies that, while training and supervision are essential, they may not independently drive compliance as effectively as the more direct and tangible

factors, such as PPE availability and effective OHS management structures. Similar findings by Lingard & Rowlinson, 2018 [1] emphasize the importance of tangible safety measures directly tied to workplace safety outcomes rather than indirect factors like general training and oversight alone.

The correlation analysis further confirms that OHS factors have a strong relationship with the level of OHS implementation, as evidenced by the positive correlation coefficients. Most respondents expressed positive views on OHS practices, reinforcing the overall positive assessment. On average, the variables under study reflect well-established and acceptable practices, in alignment with OHS standards. Field, 2018 [28] underscores the value of such statistical measures in highlighting the relationship between independent variables and target outcomes, reinforcing the findings here.

The results underscore the critical role of PPE in enhancing safety on construction sites. The use of PPE was identified as the most impactful variable on OHS implementation, highlighting the importance of ensuring adequate availability and enforcement of PPE usage among workers. This aligns with previous findings, where effective OHS implementation has been strongly associated with access to PPE and emergency equipment, such as fire extinguishers [24]. Additionally, Ismail & Chan [5] highlight that PPE, when effectively managed, serves as a key factor in accident prevention on construction sites, especially in high-risk environments like those in Southeast Asia.

In similar studies, the success rate of OHS implementation has been attributed to factors such as workers' awareness of safety protocols and the inclusion of PPE in risk-aware OHS planning. For instance, in the Summarecon Serpong project, OHS practices were observed to be effectively executed, with a success rate of 65.36% attributed to high PPE awareness and integration into OHS planning [32]. These findings highlight the necessity of incorporating PPE into strategic OHS plans as a means to ensure comprehensive safety on-site.

Additionally, research conducted on the Marvell City construction project in Surabaya emphasized the importance of OHS management, which contributed to 48.75% of OHS effectiveness [33]. This finding corroborates the significant influence of strong management frameworks in ensuring consistent and thorough implementation of OHS standards across construction sites. Hinze & Gambatese, 2019 [20] further support these findings, arguing that effective safety management systems are essential to achieve high compliance and minimize accident rates in construction projects.

The findings from this study highlight the centrality of PPE, effective OHS management, and direct implementation efforts as primary drivers of successful OHS practices. This suggests that prioritizing these elements, especially PPE access and use can substantially bolster safety outcomes on construction sites, while knowledge and supervision serve as supporting, though not independently significant, elements. These insights underscore the need for construction projects to focus on tangible and enforceable safety measures that directly impact worker behavior and compliance with safety standards. By emphasizing actionable safety measures, construction sites can move closer toward achieving a "zero accident" culture, as suggested by [9, 14], both of whom advocate for comprehensive safety systems that go beyond passive oversight.

IV. Conclusion

This study concludes that the implementation of Occupational Health and Safety (OHS) practices in construction projects has a strong positive impact on the efficiency and safety of worker activities. Overall, the analysis indicates that OHS practices are effectively implemented and aligned with expected safety standards. The key factors influencing OHS compliance are identified as Personal Protective Equipment (PPE), OHS Implementation practices, and OHS Management. These elements play a critical role in supporting consistent adherence to safety protocols on construction sites. Their combined influence reinforces the importance of having adequate PPE, strong management support, and thorough execution of OHS procedures to enhance workplace safety in the construction sector. These findings suggest that prioritizing these factors can significantly contribute to reducing workplace hazards and improving compliance with safety standards.

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