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THE INFLUENCE OF SAFETY AWARENESS ON CONSTRUCTION SAFETY PERFORMANCE

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ABSTRACT

The construction industry in Indonesia faces significant risk challenges related to the high number of work accidents. Despite the implementation of the Construction Safety Management System (SMKK) as regulated by the Minister of Public Works and Housing Regulation No. 10/202, the trend of workplace accidents continues to increase significantly every year. This shows a significant gap between regulations and implementation in the field due to a lack of attention to individual factors, especially workers' safety awareness, as low safety awareness among construction workers significantly contributes to workplace accidents. This study aims to identify safety awareness indicators, analyze their influence on safety performance, and formulate strategies to enhance safety awareness levels among construction workers. In this research, safety awareness is structured into four main variables: safety climate, safety culture, safety knowledge, and safety behavior. Safety performance is measured using leading and lagging indicators. The study employs a quantitative approach by distributing questionnaires to experts and workers engaged in building construction projects. The results of the analysis demonstrate that most of the proposed indicators effectively form safety awareness and influence safety performance, consisting of 4 variables and 28 indicators. These findings are expected to serve as a guideline for construction project management in achieving more optimal safety performance in the future.

Keywords: *Safety Awareness; Construction Workers; Safety Performance; Building Construction Project*

ABSTRAK

Industri konstruksi di Indonesia menghadapi tantangan besar terkait tingginya angka kecelakaan kerja. Meskipun Pemerintah telah mengimplementasikan Sistem Manajemen Keselamatan Konstruksi (SMKK) yang diatur oleh Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat Nomor 10 Tahun 2021, tren kasus kecelakaan kerja tetap meningkat signifikan setiap tahunnya. Fenomena ini menunjukkan adanya kesenjangan yang signifikan antara regulasi dan implementasi di lapangan akibat kurangnya perhatian pada faktor individu, khususnya kesadaran keselamatan pekerja di mana rendahnya kesadaran keselamatan pekerja konstruksi memberikan pengaruh besar terhadap kecelakaan kerja pada proyek konstruksi. Penelitian ini bertujuan untuk mengidentifikasi indikator-indikator kesadaran keselamatan dan menganalisis pengaruh indikator tersebut terhadap kinerja keselamatan serta memberikan menghasilkan strategi yang dapat meningkatkan kondisi kesadaran keselamatan di kalangan pekerja konstruksi. Kesadaran keselamatan dalam penelitian ini dibentuk ke dalam empat variabel utama yaitu iklim keselamatan, budaya keselamatan, pengetahuan keselamatan, dan perilaku keselamatan. Kinerja Keselamatan dalam penelitian ini diukur menggunakan indikator leading dan indikator lagging. Penelitian ini akan dilakukan dengan pendekatan kuantitatif melalui penyebaran kuesioner kepada pakar dan pekerja konstruksi yang bekerja di proyek konstruksi gedung. Hasil analisis menunjukkan bahwa mayoritas indikator yang diusulkan membentuk kesadaran keselamatan dan memengaruhi kinerja keselamatan terdiri dari 4 variabel dan 28 indikator. Temuan ini diharapkan dapat menjadi panduan bagi manajemen proyek konstruksi dalam mencapai kinerja keselamatan konstruksi yang lebih optimal di masa depan.

Kata kunci: *Kesadaran Keselamatan; Pekerja Konstruksi; Kinerja Keselamatan; Proyek Konstruksi Gedung*

INTRODUCTION

The construction industry is a strategic sector providing a significant contribution to the national economy through job creation and infrastructure development [1]. Empirically, the occupational accident rate in the Indonesian construction sector is recorded as the highest among other industrial sectors [2]. The high number of accidents not only threatens workers' safety but also disrupts the overall continuity of the project. This condition requires in-depth evaluation of the factors causing accidents and implementation of effective prevention to minimize the risks in the future [3]. As an effort to reduce the number of occupational accidents, Indonesian Government, through the Ministry of Public Works and Housing, has implemented the Construction Safety Management System (SMKK), regulated in the Regulation of the Ministry of Public Works and Housing Number 10 of 2021 (Indrayana & Suraji, 2021). Based on recent data, there is a concerning upward trend in occupational accidents in Indonesia. In 2023, there were 370,747 cases [4], and this number increased significantly by 24.6% to 462,241 cases in 2024 [5]. This increase is in line with the data from BPJS Ketenagakerjaan related to the number of claims for Work Accident Insurance (JKK) and Death Insurance (JKM) in Table 1**.**

Table 1. Data of JKK and JKM Claims 2019 - 2023

Year	JKK	JKM
2019	182,835	31,324
2020	221,740	32,094
2021	234,370	104,769
2022	297,725	103,349
2023	360,635	121,531

This phenomenon emphasizes that occupational safety can no longer be considered solely from the technical perspective, where it must integrate individual factors, particularly safety awareness, as a crucial element in risk mitigation [6]. In this context, safety awareness plays a central role among workers as it becomes a fundamental key for the company to balance between risk management and productivity [7].

Figure 1. Workers Do Not Use PPE While Working

Safety awareness issues often occur in construction projects, one of which is worker inconsistency in using PPE due to discomfort or perception of low occupational risk, and the situation is exacerbated by the absence of strict sanctions from the company [8]. This is as seen in Figure 1. In an effort to improve safety performance, a study of construction worker safety awareness is required. Safety performance is substantially influenced by various aspects, including safety culture, climate, behavior, and knowledge [9]. These aspects are also related to safety awareness. Safety culture has a strong impact on safety awareness [10]. Increased safety awareness will lead to increased safety behavior [6] and a good safety climate can strengthen the influence of safety awareness on safety behavior by reducing unsafe behavior [11]. Safety knowledge does not automatically translate into appropriate safety behavior; it necessitates safety awareness to effectively drive safer

practices [12]. Based on the problems described above, this study aims to:

1. Identify the safety awareness indicators contributing to forming safety awareness and influencing construction safety performance.
2. Analyze the specific safety awareness indicators that significantly influence safety performance.
3. Formulate strategic recommendations to effectively maintain and enhance safety awareness conditions.

LITERATURE REVIEW

Safety awareness can be defined as an individual's awareness of issues, risks, and the importance of safety in the work environment [13]. Safety performance is safety-related behavior that can be conceptualized similarly to other work behaviors that are work outcomes [14]. Safety performance can be assessed by the extent to which a company is able to reduce the rate of occupational accidents in a certain period [15].

RESEARCH METHOD

In this study, the X variable was safety awareness, consisting of safety climate, safety culture, safety knowledge, and safety behavior as independent variables, and the Y variable was safety performance as the dependent variable. In this study, each research instrument was described individually in each Research Question (RQ) carried out.

The Guttman Scale was used to obtain a definitive response to a problem with an answer of "Yes" with a score of 1 or "No" with a score of 0. A Likert Scale was used to measure attitude, opinion, or perception of an individual or group regarding a social phenomenon, in which the indicators are then used as a basis for compiling instrument items in the form of statements or questions, where the answer of each item is divided from very positive to very negative [16]. Content validity testing was carried out by five experts according to the profile in Table 2, who were selected based on the specific expertise criteria or purposive sampling technique to ensure that every expert has relevant competence with the research focus, and the use of five experts was considered adequate to reach objective content validity [17]. Data analysis techniques used several data analysis, including Feasibility Analysis, Data Adequacy Test, Homogeneity Test, Reliability Test, Validity Test, Regression Test, Correlation Test, and Analysis between variables used Structure Equation Modelling. Data were analyzed using calculations with the following percentage formula:

$$P = \frac{\Sigma X}{\Sigma X_{maks}} \text{ x } 100\%$$

Description:
P : Percentage of Feasibility
ΣX :Total score of expert answer
ΣX_{maks} : The highest score

The assessment criteria for the project's viability are outlined in Table 3.

Table 3. Feasibility Analysis

Percentage (%)	Description
<21%	Very Infeasible
21 – 40%	Infeasible
41 – 60%	Fairly Feasible
61 – 80%	Feasible
81 – 100%	Very Feasible

RESULTS and DISCUSSION

The initial stage of the study was to identify the safety issues. By considering the results of initial expert validation, 45 safety issues that often occur in construction projects were identified. In

this study, to find out variables and indicators that form safety awareness and influence safety performance, the researcher employed several existing literature sources and safety issues validated by experts. Four (4) sub-variables X were found, representing safety awareness, and consisting of 28 supporting indicators that were related and could influence safety performance. Two (2) sub-variables, which were leading and lagging indicators, were found to represent variable Y. When Expert 1 Validation was carried out, the number of research variables and indicators did not change because experts agreed by providing response to each explanation, both variables and indicators. This is as said in Table 4 and Table 6.

Table 4. Variables and Indicators Agreed by Experts

Code	Variable/Indicator
X. Safety Awareness	
X.1	Safety Climate
X.1.1	The Influence of Coworkers
X.1.2	Incident and Near-Miss Reporting
X.1.3	Work Pressure
X.1.4	Physical Environmental Conditions
X.1.5	Safety Equipment
X.1.6	Physical and Mental Health Conditions of Workers
X.1.7	Project Complexity
X.2	Safety Culture
X.2.1	Management Commitment
X.2.2	Safety Leadership
X.2.3	Safety Training
X.2.4	Safety Communication
X.2.5	Safety Supervision
X.2.6	Safety Evaluation
X.3	Safety Knowledge
X.3.1	Occupational Risk Knowledge
X.3.2	Education Level
X.3.3	Safety Talk
X.3.4	Work Experience
X.3.5	Occupational Accident Learning
X.3.6	Understanding of Using PPE and CPE
X.3.7	Understanding of Worker Personal Safety
X.3.8	Understanding of Safety Procedures
X.4	Safety Behavior
X.4.1	Compliance with Using PPE and CPE
X.4.2	Compliance with Safety Procedures
X.4.3	Unsafety Behavior
X.4.4	Work Habit
X.4.5	Workers' Safety Participation
X.4.6	Rewarding Workers' Compliance
X.4.7	Imposing Sanctions on Worker's Violation
Y. Safety Performance	
Y.1	Leading Indicator
Y.2	Lagging Indicator

In this study, measuring the condition of construction workers' safety awareness in building construction projects was conducted using Sigmund Freud's theory of consciousness, which contained 3 levels of consciousness in humans:

1. Level 1 = Unconscious
2. Level 2 = Preconscious
3. Level 3 = Conscious

This psychological approach is used to dissect the root of the main problem in the field, namely why workers often behave inconsistently in implementing safety at work. Based on the questionnaire data from construction workers' respondents, a relationship test between variable X and variable Y was conducted, resulting in 9 indicators in variable X, which significantly influenced variable Y. This narrowed down the problem, in which out of the 28 safety awareness indicators tested, only one-third were actually able to influence safety performance at the project site. These are presented in Table 5.

Table 5. Indicators of Variable X Significantly Influence Variable Y

Code	Indicator
X.1.3	Work Pressure

Code	Indicator
X.1.6	Physical and Mental Health Conditions of Workers
X.2.3	Safety Training
X.2.6	Safety Evaluation
X.3.2	Education Level
X.3.3	Safety Talk
X.3.6	Understanding of Using PPE and CPE
X.4.4	Work Habit
X.4.5	Imposing Sanctions on Worker Violation

Based on the results of Final Expert Validation, a strategy that can be used by a construction service company to maintain or increase the safety awareness condition of construction workers as an effort to improve safety performance in building construction projects. There were 3 levels of priority for the strategy: Priority 1 (High) was an indicator that had significant influence on 2 indicators of Variable Y, Priority 2 (Medium) was an indicator that had significant influence on one indicator of Variable Y, and Priority 3 (Low) was an indicator that did not have significant influence on 2 indicators of Variable Y.

Table 6. Strategies to Maintain/Improve Safety Awareness Conditions

Strategic Priority for Safety Awareness Condition	
Strategic Priority 1	
1	Improving Work Management
2	Implementation of Comprehensive and Demonstrative Safety Induction
3	Implementation of Periodic Safety Evaluation
4	Implementation of Interactive Safety Talk
5	Socialization and Practice of Using PPE
6	Implementation of Continuous Work Behavior Evaluation
Strategic Priority 2	
7	Implementation of Fit to Work Procedure and Monitoring Worker's Condition
8	Competency-Based Job Placement
9	Imposing Educative and Objective Sanctions
Strategic Priority 3	
10	Worker Selection and Safety Education for Foremen
11	Continuous Multi-Level Reporting
12	Implementation of 5S Culture in the Company
13	Standardization and Maintenance of PPE
14	Risk-Based Reward & Punishment System
15	Risk Mitigation at All Project Levels
16	Implementation of Role-Model-Based Leadership
17	Implementation of Multi-Channel Safety Communication
18	Implementation of Balanced Supervision
19	Comprehensive Risk Mitigation
20	Exchange of Experience Among Workers
21	Lesson Learned
22	Risk Education & Brainstorming
23	Provision of Safety Signs and Simulation of an Emergency Situation
24	Education and Supervision of Using PPE
25	System Standardization and Procedure Compliance
26	JSA Integrated Work Permit System
27	Provision of Communication Channels for Workers' Complaints
28	Providing Awards for OHS Achievement

Based on the literature study, it was obtained the relationship model between variable X and variable Y and relationship between variable X represented by latent variable (the results of regression test) and indicators of variable Y. Based on the results of regression test, the results of bootstrapping in SmartPLS application were obtained, in which R-Square value was only 16.4% in leading indicator and 17.3% in lagging indicator. Thus, variable X did not have a significant

influence on variable Y in Figure 2. The low R-Square value indicates that to address the high rate of workplace accidents, project management cannot rely solely on workers' safety awareness. This is evident in the strategy classification, where external systemic interventions such as Improving Work Management and Socialization & Practice of Using PPE are ranked as the Priority of Strategy 1. These management-controlled factors play a far more dominant role in enforcing compliance in the field than workers' safety awareness.

CONCLUSION

This study successfully identifies 45 construction safety issues based on the Regulation Number 10 (2021) of the Ministry of Public Works and Housing and validates four main safety awareness variables, including climate, culture, knowledge, and safety behavior, which consist of 28 valid indicators. Based on the Sigmund Freud's consciousness theory, it is found that the level of safety awareness in building project in Indonesia is included in "Conscious" category, where the results of regression test proves that nine specific indicators have a significant influence on safety performance, including work pressure, physical and mental health condition of workers, safety training, safety evaluation, education level, safety talk, understanding of using PPE/CPE, work habit, and imposing sanctions for workers' violations. As a follow-up, this study formulates strategies for improving health awareness validated by experts, including six high-priority strategies, six medium-priority strategies, and nineteen low-priority strategy, which collectively serve as a strategic guideline for project management in optimizing construction safety in the future.

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Table 2. Profile of Expert Respondents

Expert	Education Level	Work Experience (Year)	Position	Certification
Expert 1	Bachelor of Civil Engineering	33	Chairman of PAKKI	Senior Construction Safety Expert
Expert 2	Bachelor of Civil Engineering	24	Senior Project Manager	Associate Expert in Building Construction Engineering
Expert 3	Master of Construction Management	10	Deputy Director of the Campus Management Institute	Senior Expert in Construction Quality Management System, Expert in General Occupational Health and Safety (OHS), Junior BIM Manager
Expert 4	Master of Construction Management	22	Construction Manager	Associate Architect
Expert 5	Master of Urban Design and Development	23	Design Manager	Associate Architect

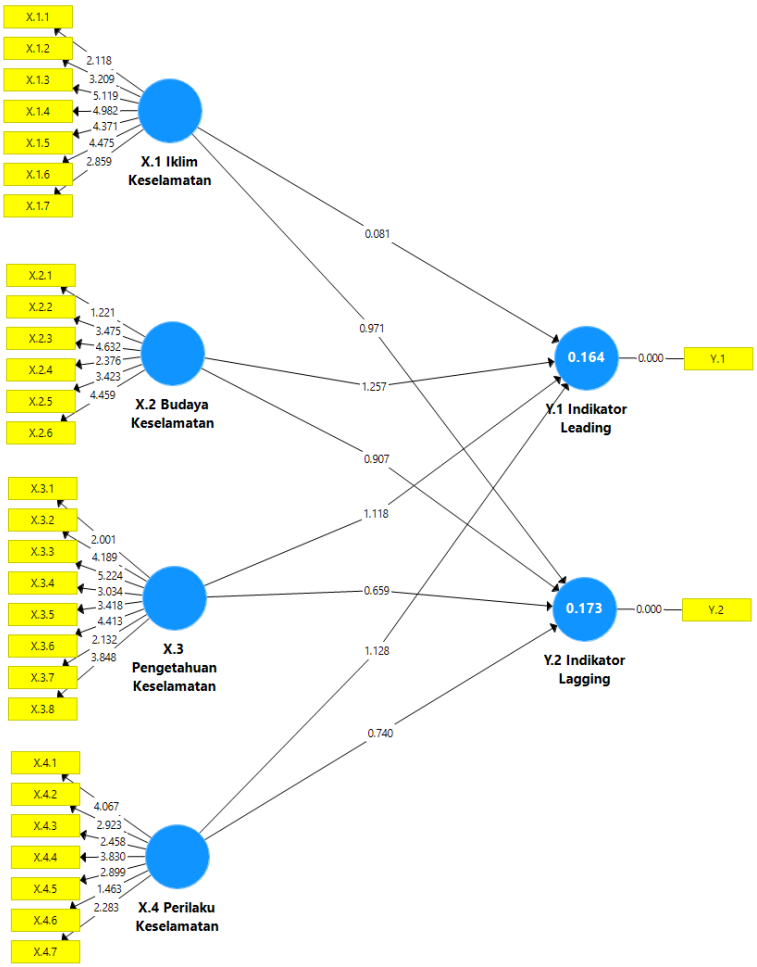

Figure 2. Analysis of the Relationship Between Variables from Bootstrapping Results in SmartPLS