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ANALYSIS OF THE EFFECT OF OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT (K3) AND RISK ASSESSMENT ON THE TIME PERFORMANCE OF TOLL ROAD INFRASRUCTURE PROJECTS WITH JOB SATISFACTION AS AN INTERVENING VARIABLE BASED ON SEM-PLS

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Abstract

Time performance is one of the key indicators of project success, especially in toll road infrastructure projects with strict deadlines. This study aims to analyze the influence of Occupational Health and Safety (OHS) Management and Risk Assessment on Time Performance through Job Satisfaction as an intervening variable using the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method. Data were collected from workers involved in toll road infrastructure projects and analyzed using a quantitative approach.The results indicate that Risk Assessment and OHS Management have a positive and significant effect on Job Satisfaction, with path coefficient values of 15.312 and 9.116, respectively. Additionally, Job Satisfaction significantly affects Time Performance (path coefficient = 2.625). Further analysis reveals that Risk Assessment and OHS Management also have a significant impact on Time Performance through Job Satisfaction, with path coefficient values of 2.923 and 2.507, respectively. This finding suggests that effective OHS management and risk assessment processes can enhance worker satisfaction, ultimately leading to improved project completion efficiency.This study highlights the importance of integrating safety management and risk assessment into project management strategies to enhance time efficiency in toll road infrastructure projects.

Keywords: OHS Management, Risk Assessment, Job Satisfaction, Time Performance, SEM-PLS

INTRODUCTION

An incident is a foreseeable or unforeseen event that has the potential to disrupt production/operations, cause property/asset damage, endanger individuals, or negatively impact the environment. Incidents may not always result in physical injury; however, they can result in damage to existing resources and machinery. Therefore, occupational safety plays a crucial role in minimizing work-related incidents that cause various forms of harm, including injury, disability, property damage, and environmental degradation. In today's era of globalization, the construction industry has emerged as a major driver of economic progress in various countries. The prosperity of construction efforts, particularly those focused on highway infrastructure, significantly impacts economic progress and individual well-being. However, this sector also faces various challenges, including project delays and high occupational safety and health (OSH) risks (Koehn et al., 1995).

The application of risk management assessment methods in the context of OHS is one approach to identifying, analyzing, and managing risks that may occur during project implementation (Hallowell & Gambatese, 2009; Zhou et al., 2012). Meanwhile, risk assessment not only serves to prevent accidents but also influences workers' perceptions of the work environment. This process not only reduces the likelihood of workplace accidents and project delays but also increases the efficiency and effectiveness of the overall construction project implementation. In the implementation of toll road infrastructure projects, timely completion is one of the main indicators of project success. However, in practice, project delays still frequently occur, caused not only by technical or financial factors but also by human resources and occupational safety management. In addition to directly impacting project operations, weak implementation of occupational safety and health (K3) and risk assessment also affects workers' psychological well-being. Furthermore, job satisfaction plays a significant role in influencing project time performance. Therefore, statistical analysis calculations are needed to classify phenomena occurring in toll road infrastructure projects in Indonesia, which is expected to improve occupational safety standards and reduce the still-high rate of workplace accidents. Given the background explanation provided above, the author is interested in

conducting a study entitled "Analysis Of The Effect Of Occupational Safety And Health Management (K3) And Risk Assessment On The Time Performance Of Toll Road Infrasructure Projects With Job Satisfaction As An Intervening Variable Based On SEM-PLS"

LITERATURE REVIEW

Toll Road Infrastructure Project Accidents

Toll road infrastructure projects in Indonesia have experienced a significant increase in work-related incidents, rising significantly from 123,040 cases in 2017 to 234,270 in 2021, representing an average annual increase of 18%. The occurrence of these incidents is influenced by various factors, including internal workforce factors such as occupational safety, health, and employee fitness, which demonstrate a strong and substantial influence on accident transmission.

Risk Management (OHS)

Overview of Toll Road Construction Accidents Due to Failure to Meet Occupational Safety, Security, and Health (OHS) Criteria. Toll road construction accidents caused by failure to meet OHS criteria can occur in various forms and have significant impacts. By implementing OHS effectively, it is hoped that toll road construction accidents due to OHS failures can be minimized and the safety of workers, the surrounding community, and the environment can be maintained.

Risk Assessment

Aven (2016) emphasizes that risk assessment is the process of describing and characterizing risks in various activities and systems, taking into account inherent uncertainty.

Job Satisfaction

According to Robbins and Judge (2019), job satisfaction is a positive feeling about one's job resulting from an evaluation of the job's characteristics.

Risk Management Over Time

It is crucial to consider mitigating and preventing workplace accidents among workers through the enforcement of safety protocols, health regulations, and occupational health and safety planning as integral components of workforce protection, ensuring the smooth progress of construction activities while upholding occupational safety and health standards during project implementation.

Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a statistical technique that combines factor analysis from psychology and psychometrics with simultaneous equation modeling from econometrics (Ghozali, 2014).

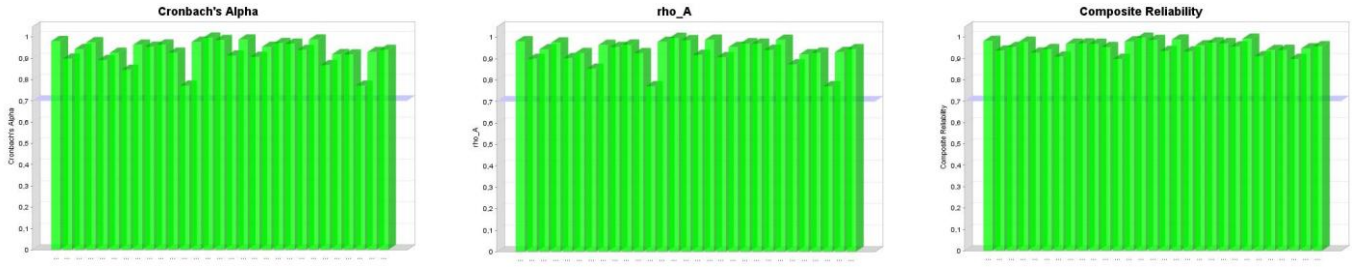
METHOD

In the current study, researchers conducted a survey to examine the factors influencing the problem at hand. The research subjects were the toll road construction project, which crosses two regions: Central Java, encompassing Karanganyar, Boyolali, and Klaten Regency; Yogyakarta Special Region, encompassing Sleman, Kulon Progo, and Bantul Regency; and the Bogor-Ciawi-Sukabumi Toll Road Section III. Data collection was conducted through questionnaires. Primary data were obtained from stakeholder questionnaires, including those from contractors, consultants, and secondary data owners. Secondary data were obtained through documents, files, or archives related to the project. The research variables used were Risk Management Assessment (X1), Occupational Safety and Health (K3) (X2), Job Satisfaction (Z1), Project Time Performance (Y), and Toll Road Infrastructure Project. Data analysis used the Structural Equation Modeling (SEM) method, which was then processed through editing and scoring stages. This study used the SEM-PLS version 3.0 application. This study consists of 170 sub-factors from 4 tested parameters and 25 main factors/dimensions. The 170 sub-factors will then be sorted into 10 influential factors, and then from the 25 main factors, 5 influential factors will also be sought. In this study, researchers used a minimum of 30 people who participated in the toll road construction.

RESULTS AND DISCUSSION

Outer SEM-PLS Analysis / External Relationship Measurement Model

Based on the results of the construct reliability test conducted by the researcher based on convergent validity, each construct demonstrated a Cronbach's alpha and composite reliability value greater than or equal to 0.7, indicating that the established criteria had been met, thus establishing the validity of each construct. The diagram shown in image 1 below illustrates the results of Partial Least Squares Structural Equation Modeling (PLS SEM) data manipulation to evaluate the reliability and validity of Cronbach's alpha for testing.



(a) (b) (c)

Image 1: (a) Cronbach's Alpha Diagram Graph, (b) Rho-A Diagram Graph, (c) Composite Reliability Diagram Graph

Based on the figure above, it is clear that each construct has a Cronbach's alpha coefficient equal to or greater than 0.7. Thus, it can be concluded that each construct has met the reliability requirements and is considered authentic.

SEM-PLS Inner Loading Analysis / Inner/Structural Measurement Model

1. Direct Effect Test

The results of direct effect test, which are presented in Table 1 below:

Table 1. Path Coefficient Analysis - T Statistics and P Value

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
"TIME PERFORMANCE (Y1)" -> Time and Schedule (Y1.1)	1,000	1,000	0,00	15782,814	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Affecting Safety and Health On Construction Projects_(X2.6)"	0,988	0,988	0,002	472,012	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Challenge in Developing Countries_(X2.7)"	0,969	0,969	0,006	171,897	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Construction Health and Safety Responsibilities_(X2.8)"	0,980	0,980	0,004	267,418	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Elements of Construction Safety Management System_(X2.10)"	0,959	0,959	0,006	157,018	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Emergency Management System_(X2.15)"	0,932	0,932	0,011	83,150	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Evaluation of Project Safety Program_(X2.9)"	0,977	0,978	0,005	182,607	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Risk Assessments and Management_(X2.11)"	0,926	0,925	0,012	75,408	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Risk Identification_(X2.4)"	0,972	0,972	0,005	211,808	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Safe Work Practices_(X2.12)"	0,897	0,897	0,012	74,577	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Safety Inspection System_(X2.14)"	0,989	0,989	0,002	593,924	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "Safety Training and Competency of People Involved_(X2.13)"	0,911	0,911	0,014	65,910	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "TIME PERFORMANCE_(Y1)"	0,529	0,530	0,249	2,124	0,34
HEALTH AND SAFETY MANAGEMENT (X2) -> "The Effects of Accidents Costs On Construction_(X2.5)"	0,963	0,963	0,007	134,490	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1)	1,016	1,019	0,111	9,116	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> Risk Management (X2.1)	0,973	0,974	0,007	144,706	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> Risk Market (X2.3)	0,958	0,958	0,007	135,770	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> Risk Technology (X2.2)	0,898	0,901	0,017	52,766	0,00
JOB SATISFACTION (Z1) -> "TIME_PERFORMANCE (Y1)"	0,392	0,395	0,149	2,625	0,009
JOB SATISFACTION (Z1) -> Job Promotion (Z1.5)	0,975	0,975	0,004	226,477	0,00
JOB SATISFACTION (Z1) -> Salary (Z1.2)	0,919	0,919	0,011	326,822	0,00
JOB SATISFACTION (Z1) -> Superior at Work (Z1.4)	0,982	0,983	0,003	84,821	0,00
JOB SATISFACTION (Z1) -> The Job Itself (Z1.1)	0,978	0,977	0,004	275,937	0,00
JOB SATISFACTION (Z1) -> Work Colleague (Z1.3)	0,984	0,984	0,002	412,066	0,00
JOB SATISFACTION (Z1) -> Work Environment (Z1.6)	0,866	0,866	0,023	37,560	0,00
RISK ASESSMENT (X1) -> "TIME PERFORMANCE (Y1)"	0,043	0,040	0,178	2,241	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1)	1,035	1,038	0,113	15,312	0,00
RISK ASESSMENT (X1) -> Risk Frequency According (X1.2)	0,889	0,889	0,017	50,933	0,00
RISK ASESSMENT (X1) -> Risk Register According (X1.1)	0,992	0,992	0,001	691,390	0,00
RISK ASESSMENT (X1) -> Social Network Cybersecurity Risk Assessment (X1.3)	0,977	0,977	0,005	202,767	0,00

2. Indirect Effect

The results of indirect effect, shown in Table 2 below :

Table 2. Specific Indirect Effect Analysis - T Statistics and P Value

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> "TIME PERFORMANCE_(Y1)"	0,398	0,402	0,159	2,507	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> "TIME PERFORMANCE (Y1)"	0,014	0,014	0,047	2,923	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> Job Promotion (Z1.5)	0,991	0,993	0,110	9,049	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> Job Promotion (Z1.5)	0,034	0,037	0,110	0,312	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> Salary (Z1.2)	0,934	0,936	0,103	9,051	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> Salary (Z1.2)	0,032	0,035	0,104	0,312	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> Superior at Work (Z1.4)	0,999	1,002	0,110	9,058	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> Superior at Work (Z1.4)	0,035	0,037	0,111	0,312	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> The Job Itself (Z1.1)	0,994	0,996	0,109	9,150	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> The Job Itself (Z1.1)	0,035	0,037	0,111	0,312	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> "TIME PERFORMANCE (Y1)" -> Time and Schedule (Y1.1)	0,529	0,530	0,249	2,124	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> "TIME PERFORMANCE (Y1)" -> Time and Schedule (Y1)	0,398	0,402	0,159	2,507	0,00
JOB SATISFACTION (Z1) -> "TIME PERFORMANCE_(Y1)" -> Time and Schedule (Y1.1)	0,392	0,395	0,149	2,625	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> "TIME_(Y)" -> Time and Schedule (Y1.1)	0,014	0,014	0,047	0,292	0,00
RISK ASESSMENT (X1) -> "TIME PERFORMANCE (Y1)" -> Time and Schedule (Y1.1)	0,043	0,040	0,178	0,241	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> Work Colleague (Z1.3)	1,000	1,003	0,109	9,144	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> Work Colleague (Z1.3)	0,035	0,037	0,111	0,312	0,00
HEALTH AND SAFETY MANAGEMENT (X2) -> JOB SATISFACTION (Z1) -> Work Environment (Z1.6)	0,881	0,881	0,088	10,038	0,00
RISK ASESSMENT (X1) -> JOB SATISFACTION (Z1) -> Work Environment (Z1.6)	-0,031	-0,032	0,098	0,314	0,00

Hypothesis Testing

Based on the test results presented in Table 1, the path coefficient value of the Assessment Risk (X1) on project performance (Z1) is 15.312, then the T-Statistic value > T in Table 4.14 (15.312 > 1.96) and the P-Value < Significance Level (0.00 < 0.05), it can be concluded that Project Operational Risk (X1) has a significant effect on Project Performance (Z1), thus **H1 is accepted.** The test results displayed in Table 1 show the path coefficient value of Health and Safety Management (X2) on Job Satisfaction (Z1) is 9.116; then the T-Statistic value > T Table (9.116 > 1.96) and the P-Value < Significance Level (0.00 < 0.05). It can be concluded that Health and Safety Management (X2) has a significant effect on Job Satisfaction (Z1); thus, **H2 is accepted.**

The test results displayed in Table 1 show that the path coefficient value of Job Satisfaction (Z1) on Time Performance (Y1) is 2.625; the T statistic value is greater than the T table (2.625 > 1.96); and the P-value is less than the significance level (0.00 < 0.05). Then it can be concluded that Job Satisfaction (Z1) has a significant effect on Time Performance (Y1); thus, **H3 is accepted.** The test results displayed in Table 2 to Table 2 show that the path coefficient value of Risk Assessment (X1) on Time Performance (Y1) through Job Satisfaction (Z1) is 2.923; then the T Statistic value > T table (2.923 > 1.96) and the P-Value < Significance Level (0.00 < 0.05). It can be concluded that the project operational risk (X1) has a significant effect on construction disputes (Y1) through project performance (Z1); thus, **H4 is accepted.** The test results displayed in Table 2 show that the path coefficient value (X2) of Health and Safety Management (X2) on Time Performance (Y1) through Job Satisfaction (Z1) is 2.507; then the T statistic value > T table (2.507 > 1.96) and the P-value < significance level (0.00 < 0.05). It can be concluded that Project Management (X2) has a significant effect on Construction Disputes (Y1) through Project Performance (Z1); thus, **H5 is accepted.**

Discussion

1. The Effect of Risk Assessment (X1) on Job Satisfaction (Z1)

Based on the data analysis, it was found that risk assessment has a significant impact on job satisfaction. Systematically documenting risks allows for better risk management and ensures that risks are not overlooked, which increases workers' sense of security and provides clarity regarding risk mitigation.

2. The Effect of Health and Safety Management (OHS Management) (X2) on Job Satisfaction (Z1) in a toll road infrastructure project

Based on the data analysis, it was found that OHS management has a significant impact on job satisfaction. The Safety Inspection System (X2.14) was the most dominant dimension within the Management stage, significantly impacting job satisfaction. Research by Morgan et al. (2021) found that job satisfaction has a significant positive effect on occupational health and safety management.

3. Relationship between Job Satisfaction (Z1) and Time Performance (Y1) in toll road infrastructure projects

Job satisfaction (Z1) has a significant relationship with time performance (Y1). High job satisfaction impacts timely project completion. Based on research by Wicaksono & Brata (2022), this study examines the impact of job satisfaction on construction project completion times.

4. The Effect of Risk Assessment (X1) on Time Performance (Y1) through Job Satisfaction (Z1) in Toll Road Infrastructure Projects

The findings of this study indicate that risk assessment (X1) significantly influences time performance (Y1) through job satisfaction (Z1) as an intervening variable. Poorly implemented risk assessments will create problems in project timeline completion and reduce job satisfaction.

5. The Effect of Health and Safety Management (OHS) (X2) on Time Performance (Y1) through Job Satisfaction (Z1) in Toll Road Infrastructure Projects

Based on the analysis, it was found that the role of OHS management (X2) significantly influences time performance (Y1) through job satisfaction (Z1). Research by Ende and Firdaus (2021) indicates that job satisfaction can act as a mediator between variables related to performance effectiveness.

CONCLUSION

Based on the research results, it can be concluded that risk assessment and health and safety management have a positive and significant effect on job satisfaction. Furthermore, job satisfaction also has a positive and significant effect on time performance. Furthermore, risk assessment and health and safety management have a significant effect on time performance through Job Satisfaction.job satisfaction.

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