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Research Paper

Assessment of Security, Health, Safety, and Environmental Sustainability Risk for Toll Road Construction Workers

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ABSTRACT

Preventing accidents and work-related diseases is an important factor that must be considered in construction activities. The problem that has occurred recently is that the majority of work accidents occur due to human negligence and unsafe actions. Therefore, it is necessary to commit worker awareness in addition to safety, health, security and environmental sustainability (SHSE), where SHSE also pays attention to non worker factors or sustainability after construction to maintenance around the construction site environment. The research aims to analyze the influence of worker behavior on SHSE risk assessments in case studies on the Becakayu Section II-A toll road construction project—quantitative descriptive research method involving 90 workers as respondents. The research results show that SHSE is partially influenced significantly by the variables Employee Knowledge, Employee Attitude, and Employee Action. At the same time, Worker Knowledge, Worker Attitudes and Worker Actions simultaneously have a significant effect on SHSE in the construction of the Becakayu Toll Road section II-A. The research conclusions underline that workers with high knowledge are aware of SHSE behavior, workers' attitudes toward SHSE still require strong commitment, and workers' actions regarding SHSE need to increase awareness of using personal protective equipment to reduce the risk of occupational accidents.

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1. Introduction

National Strategic Projects aim to increase economic growth in an area. The National Strategic Projects in Road Infrastructure are national and toll road construction projects. According to the Toll Road Regulatory Agency (2020), the Becakayu Toll Road (Bekasi-Cawang-Kampung Melayu) was built as an elevated road that stretches from the Tambun-Bekasi area to the Kampung Melayu area and has a length of 21.04 km.

Recently, there have been many industrial accidents, most caused by human negligence. Therefore, Law Number 2 of 2017 concerning construction services explains that the policy focus is not limited to OSH (occupational safety and health) for construction workers. However, it is also necessary to pay attention to other broader aspects, namely safety, health, security, and environmental sustainability (SHSE). SHSE not only focuses on factors unrelated to workers or postconstruction sustainability but is also concerned with maintaining conflict around the construction site environment. The large number of construction accidents that occur shows that safety in construction has still been neglected. Therefore, serious coordination between the government and stakeholders is needed in the construction sector so that SHSE development can be implemented in all construction projects (Baka et al., 2022; Purwanti et al., 2023; Soeharto, 2016; Yuvendra et al., 2022).

Many construction workers still need to pay attention to their occupational health and safety aspects, so project accidents often occur (Mudzakir et al., 2023; Sánchez et al., 2017). Diaphragm work on the Kalimalang arterial road is at high risk for project workers and road users who could be hit by falling material and by splashes of concrete mix during the casting process (Arya et al., 2020; Irianto et al., 2022). Therefore, it is necessary to analyze the risks in the project. The factors that created a problem in this research were as follows: (1) National construction project accidents throughout 2018 were 57,313 out of 157,313 work accidents. Thus, the number of work accidents on construction projects is still relatively high. (2) Diaphragm work on the Kalimalang arterial road is highly risky for road users and project workers.

Previous studies by Lensun et al. (2022) and Juarsa et al. (2023) have shown that worker behavior influences security, safety and health risk assessments and risk control efforts carried out based on the OSH hierarchy, namely, technical engineering, the administration and the use of personal protective equipment or PPE (Kartikasari & Sukwika, 2021; Sulistyowati & Sukwika, 2022). Research conducted by La and Chaiddir (2022) and Baka et al. (2022) showed that the attitude of construction workers influences K3 risk assessment. Based on the background of the problem and research gaps from previous research, it is important to study the influence of the implementation of occupational safety and health management and work environment conditions on work safety behavior in the Becakayu section II-A toll road construction project.

2. Research Method

2.1. Types of Methods and Data Sources

The research method used was descriptive and quantitative. The data were collected using a questionnaire tool to test predetermined hypotheses. The research was conducted on workers at the Becakayu Section II-A Toll Road Construction Project. The research was conducted from November 2022 to February 2023. The data were collected by observing and distributing questionnaires directly to project managers as sample respondents. Quantitative analysis was performed using a Likert scale by explaining the indicators of each variable with the terms strongly agreed (SA) given a weight=5, Agree (A)=4, neutral (N)=3, disagree (D)=2 and strongly disagree (SD)=1.

2.2. Population and Samples

The population is the entire unit of analysis and is the target of the research; additionally, characteristics that are the center of attention contain information that one wants to know (Sugiyono, 2019; Sukwika, 2023a).

The population of this study included Company employees involved in completing the Becakayu Section II-A Toll Road construction project and supervisory consultants.

By considering the characteristics of the existing population and the objectives of this study, the determination of respondents to be sampled was carried out using a purposive sampling method. Purposive sampling is a method for obtaining data sources that has received particular attention (Sugiyono, 2019; Sukwika, 2023a). The respondents selected from the population met the following criteria: had (1) a contractor service employee involved in the Becakayu Section II-A Toll Road Construction Project, (2) more than two years of work experience, (3) a supervisory consultant, and (4) were willing to be a respondent to this research.

If the population is not known, then sample selection can use the Lemeshow formula. where n = number of samples; Zα = standard value of the distribution according to the value α = 5% = 1.96; P = maximum estimate of 0.50; and E = the amount of error that can be accepted is 10% = 0.10 (Alma & Sunarto, 2007; Sukwika, 2023a). The Zα value obtained from the normal distribution table is 1.96. The allowable error (E) is 10%, and the highest estimate (P) is 0.50. Based on previous calculations, the sample size for this study was 89.04, which was then rounded to 90 individuals. Here, is the calculation:

$$n = \frac{(Z\propto^2 P\ (1-P)}{E^2} \qquad \text{n} = \frac{(1{,}96^2\ 0{,}5\ (1-0{,}5)}{1^2} = 89{,}04$$

2.3. Data analysis technique

Validity and Reliability Test. Factor validity is related to the accuracy of the measuring instrument in carrying out its measuring function. This validity analyses the relationship between factors and each variable (Sukwika, 2023a; Utami et al., 2020)—validity was measured using Pearson product moment correlation calculations from the SPSS Version 25 program. The criteria for testing item validity are as follows: (1) If the value of rcount< rtable, then the item is invalid. (2) If the value of rcount>rtable, then the item is valid. The reliability of the research instruments was tested with the Cronbach's alpha. The reliability testing criteria are as follows: (a) if the alpha value is > 0.60, then the instrument is declared reliable; and (b) if the alpha value is <0.60, then the instrument is not reliable (Sugiyono, 2019; Sukwika, 2023a).

2.4. Hypothesis testing

Hypothesis testing involved inferential statistical analysis, including multiple regression and correlation analysis, t tests and f tests, and determination of the coefficient of determination. The analysis tests are presented in more detail as follows:

Multiple linear regression test. The multiple linear regression method is applied in this research to measure how large the relationship is between two or more variables. Additionally, it shows the direction of the relationship between variables, whether they have a positive or negative relationship. The dependent variable used in this research is the implementation of the SHSE (Y). The independent variables used in this research are worker knowledge (X_1), worker attitudes (X_2) and worker actions (X_3). A simple linear regression analysis model can be formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \text{Ɛ}$$

Information:

Y = SHSE (security, health, safety, and environmental sustainability)

X1 = Worker knowledge; X2 = Worker attitude; X3 = Worker action

α = Constant; β = coefficient of variable X; Ɛ = error

The following variables were tested: Worker Knowledge (X_1), which includes $X_{1.1}$ The importance of implementing SHSE in Development, Work Procedures & Safety Signs, and $X_{1.5}$ Training The importance

of knowledge of implementing sustainable maintenance of the environment around the project. Worker Attitudes (X_2) include $X_{2.1}$ Implementation of SHSE Related Standard Regulations and 5 Actions against Violations of the Use of PPE. Worker actions (X_3) include $X_{3.1}$ Atmosphere and working relationships in the workplace or after project completion. The SHSE (Y) includes Y_1, which installs safety signs and provides evacuation routes in the event of an emergency; Y_2, which implements environmental management standards by statutory provisions; Y_3, which involves the construction of toll roads that cause damage to public facilities in areas affected by the project; and Y_4, which damages facilities and roads. The main environmental damage caused by development includes air pollution, noise pollution, erosion along rivers, and aridity due to the cutting of green belts; and Y_5, which improves environmental conditions after development.

Coefficient of Determination Test (R^2). The coefficient of determination measures the extent to which the independent variable explains the variation in the independent variable. The value of the coefficient of determination ranges from 0 to 1 ($0<R^2<1$). A small R^2 value indicates the ability of variations in the independent variable to explain the independent variables, which provides almost all the information needed to predict variations in the dependent variable (Ghozali, 2019; Sukwika, 2023b). A coefficient of determination = 0 indicates that there is no relationship between the independent variable and the dependent variable; a coefficient of determination = 1 indicates that there is a perfect relationship.

F test (simultaneous) and test (partial). Statistical tests are intended to determine how large the influence of independent variables in groups (simultaneously) individually (partially) is in explaining the dependent variable. Testing was carried out using a significance level of 0.05. Rejection or acceptance of the hypothesis is based on the following criteria (Sukwika, 2023b): (a) significance value ≤ or = 0.05 indicates that the independent variable affects the dependent variable; (b) a significance value ≥ 0.05 indicates that the independent variable does not affect the dependent variable.

3. Results and Discussions

3.1. Results

Worker Knowledge (X_1). The Worker's Knowledge variable (X_1) averages 3.791, which is in the high category because it exceeds the range of 3.41 to 4.20. The most influential indicator is X1.5, which refers to understanding the sustainability of the maintenance of the environment around the project. Notoatmojo (2014) defines knowledge as the result of sensory perception or understanding obtained through the five senses. Notoatmojo (2014) states that behavior rooted in knowledge tends to be more sustainable than behavior that lacks knowledge.

Worker Attitude (X_2). The Worker Attitude variable (X_2) generally averaged 3.862 and was included in the high category because it exceeded the value of 3.41 to 4.20. The most influential indicator is $X_{2.2}$, namely, a positive atmosphere and strong working relationships in the workplace. Notoatmojo (2014) defines attitude as agreeing or disagreeing with someone's likes or dislikes. Work attitudes include positive or negative assessments made by individuals toward their work environment, including workers' attitudes toward a conducive working atmosphere and relationships in the workplace, which are strongly agreed upon by respondents. Lensun et al. (2022) and Baka et al. (2022) stated that workers' positive attitudes toward the SHSE program result from company efforts to prioritize worker safety and health. The positive relationship between the attitude toward implementing the SHSE program and the company shows that the program is perceived positively, effectively, safely and by procedures, thereby creating a sense of confidence in the company's concern for its workers.

Worker action (X_3). The Worker Action variable (X_3) generally averages 3.683 and is included in the high category because it exceeds the value range of 3.41 to 4.20. The dominant indicator is $X_{3.3}$, which refers to paying attention to safety signs and complying with standard operational procedures in the workplace. According to Notoatmojo (2014), action is the practical application of knowledge and attitudes, which are

interconnected and lead to real action. Other people can easily observe this action, also called overt behavior. Mustofa et al. (2023), Purwanti et al. (2023), and Wary et al. (2023) emphasize the importance of workers understanding the meaning of safety signs in the workplace and actively participating in safety discussions. The main causes of work safety problems are unsafe behavior, which accounts for 88%, and unsafe environmental conditions, which account for 10%.

Security, Health, Safety and Sustainability (SHSE) (Y). The Security, Safety, Health and Sustainability (SHSE) (Y) variable generally has an average value of 3.853; this variable is included in the high category because it exceeds the range of 3.41 to 4.20. The main indicator is Y_4, which reflects specific environmental damage due to development, such as air pollution, noise pollution, river erosion and loss of green space. For example, construction services that implement sustainable construction practices include implementing a construction safety management system (CSMS) and fulfilling security, health, safety, and sustainability (SHSE) standards to create high-quality infrastructure (Baka et al., 2022; Sánchez et al., 2017; Wary et al., 2023). Effective construction project management requires understanding environmentally friendly building practices to minimize negative environmental and occupational health impacts. This condition includes considering the health and comfort aspects of the project environment, such as air quality planning and reducing noise generated by construction activities. Environmental management in construction projects focuses on reducing waste generation during construction activities.

3.1.1. Testing the Validity of Research Instruments

This validity test is conducted to measure whether the data obtained after the research are valid using the measuring instrument (questionnaire). The questionnaire items are declared valid as a data collection tool. Validity testing ensures that the compiled questionnaire will be good at measuring symptoms to produce valid data. One method that can be used to carry out a validity test is to correlate the value of each item with the total score of all questions (the data are included in the data attachment). A question item is said to be valid if the value of the Pearson correlation coefficient is greater than the value of the Pearson correlation coefficient in the table (rcount>rtable). A validity test with a sample size of n = 90 and a significance level ($\propto = 0.05$) showed that the rtable value was 0.207. The results of the r-xy calculation can be found in Table 1.

The results of the product-moment correlation calculation in the table above show that the score for each statement is significantly correlated with the total score, indicated by the calculated r being greater than the rtable. It can be concluded that all the question items are valid and can be used as a data collection tool for this research. Table 2 shows that the alpha and Cronbach's alpha values for all the variables are greater than 0.6. In this way, all the questionnaire items were declared reliable and suitable for data collection.

3.1.2. Classic Assumption Test Results

Therefore, the estimates obtained do not deviate from the multiple linear regression equation model; they must meet the following classical assumptions:

Normality test. The normality test aims to test whether the residual values have a normal distribution in the regression model. A good regression was used if the data were normal or close to normal. The normality test results can be seen from the one-sample Kolmogorov–Smirnov test in the Sig section. The basis for decision-making: (a) if the probability value (Sig.) <0.05, then the distribution is not normal; (b) if the probability value (Sig.) > 0.05, then the distribution is normal. Table 3 shows that the residual value is normally distributed because the probability value (Sig.) is 0.200 > 0.05. Furthermore, below is the normality test using the PP plot. Figure 1 shows that if the data spread in the direction of the diagonal line, then the assumption of normality can be met. The regression model does not meet the normality assumption if the data are spread far from the diagonal line. The results of the normality test are shown below. The graph above shows that

the data are spread around the diagonal line, and the distribution follows the diagonal line; this means that the data are normally distributed. Thus, the regression model is suitable for use in research.

Table 1. Validity test results

Variable	Item	Correlation Value (R-Count)	R-Tabel (n = 90; A = 5%)	Description
Worker Knowledge (X1)	$X_{1.1}$	0.768	0.207	Valid
	$X_{1.2}$	0.828	0.207	Valid
	$X_{1.3}$	0.717	0.207	Valid
	$X_{1.4}$	0.794	0.207	Valid
	$X_{1.5}$	0.768	0.207	Valid
Worker Attitude (X2)	$X_{2.1}$	0.787	0.207	Valid
	$X_{2.2}$	0.792	0.207	Valid
	$X_{2.3}$	0.736	0.207	Valid
	$X_{2.4}$	0.803	0.207	Valid
	$X_{2.5}$	0.739	0.207	Valid
Worker Action (X3)	$X_{3.1}$	0.910	0.207	Valid
	$X_{3.2}$	0.895	0.207	Valid
	$X_{3.3}$	0.831	0.207	Valid
	$X_{3.4}$	0.847	0.207	Valid
Security, Health Safety, and Sustainability (SHSE) (Y)	Y_1	0.778	0.207	Valid
	Y_2	0.762	0.207	Valid
	Y_3	0.802	0.207	Valid
	Y_4	0.783	0.207	Valid
	Y_5	0.649	0.207	Valid

Table 2. Reliability test results

Variable	*Alpha-Cronbach*	Description
Employee Knowledge (X_1)	0.834	Reliable
Worker Attitude (X_2)	0.825	Reliable
Worker Actions (X_3)	0.892	Reliable
Security, Health Safety, and Sustainability (SHSE) (Y)	0.806	Reliable

Table 3. Normality Result

One-Sample Kolmogorov– Smirnov Test		
		Standardized Residual
n		90
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	.97726976
Most Extreme Differences	Absolute	.059
	Positive	.057
	Negative	-.059
Test Statistic		.059
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

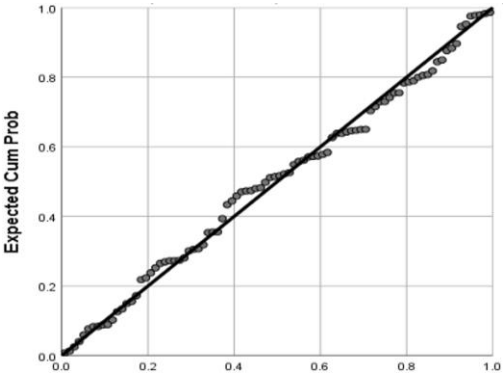

Figure 1. P-P Plot Normalitas Test

Multicollinearity test. The presence of multicollinearity was assessed using the volume inflation factor (VIF). Multicollinearity is needed to determine whether there are similarities between independent variables in a particular model. Multicollinearity problems arise when a strong relationship or influence exists between two or more variables. A VIF of an independent variable less than 10 indicates no multicollinearity. On the

other hand, a VIF greater than 10 indicates multicollinearity. The results of the multicollinearity test analysis are presented in Table 4, which contains data for variable X_1.

Glejser heteroscedasticity test. Heteroscedasticity can be assessed using the Glejser test, which involves the regression of independent variables against the absolute value of their residuals. Decision-making is based on the significance value between the independent variables and the absolute residual. A significance value greater than 0.05 indicates no heteroscedasticity. Conversely, if the significance value is less than 0.05, then heteroscedasticity occurs. Table 5 shows that all the significance values are greater than 0.05, indicating that heteroscedasticity does not occur in the regression model.

Table 4. Multicollinearity Results

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-3.236	2.502		-1.293	.199		
	Employee Knowledge (X_1)	.208	.074	.215	2.818	.006	.625	1.601
	Worker Attitude (X_2)	.308	.071	.305	4.333	.000	.732	1.366
	Worker Actions (X_3)	.419	.075	.404	5.551	.000	.683	1.464

Multiple linear regression analysis. Multiple linear regression analysis was used to determine the extent to which the independent variables, namely, worker knowledge, worker attitudes and worker actions, influence SHSE (Y). The results of the multiple regression analysis can be found in Table 6.

Table 5. Heteroscedasticity Test

Coefficients[a]

Model		Unstandardized Coefficients		Stand-ardized Coeffi-cients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.294	1.547		1.483	.142
	Employee Knowledge (X_1)	.004	.046	.011	.083	.934
	Worker Attitude (X_2)	.043	.044	.123	.985	.327
	Worker Actions (X_3)	-.066	.047	-.183	-1.420	.159

a. Dependent Variable: Absolute Residual

Table 6. Multiple Linear Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Stand-ardized Coeffi-cients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.236	2.502		-1.293	.199
	Employee Knowledge (X_1)	.208	.074	.215	2.818	.006
	Worker Attitude (X_2)	.308	.071	.305	4.333	.000
	Worker Actions (X_3)	.419	.075	.404	5.551	.000

a. Dependent Variable: Absolute Residual

From the table above, the regression equation is as follows:

$$\boldsymbol{Y = -3.236 + 0.208\ X_1 + 0.308\ X_2 + 0.419\ X_3}$$

Based on the regression equation, it is known that:

a) The constant value was -3.236. This means that if the variables X_1, X_2, and X_3 are equal to 0 (zero), then Y is -3.236.
b) X_1 is positive at 0.208. This means that X_1 positively influences Y, meaning that an increase in X_1 by 1 unit causes Y to increase by 0.308; otherwise, the regression coefficient is negative.
c) X_2 is positive at 0.308. This means that X_2 positively influences Y. If X_2 increases by 1 unit, Y will increase by 0.308; otherwise, the regression coefficient will be negative.
d) X_3 is positive at 0.419. This means that X_3 positively influences Y. If X_3 increases by 1 unit, Y increases by 0.419; otherwise, the regression coefficient is negative.

3.1.3. Hypothesis test

Coefficient of determination (R^2). The coefficient of determination is used to measure the model's ability to explain changes in the dependent variable. It ranges between zero and one. A low R^2 value indicates that the independent variable cannot explain changes in the dependent variable. A high R^2 value indicates that the independent variable is very informative in predicting changes in the dependent variable (Sukwika, 2023b). Table 7 shows that the adjusted R^2 value is 0.678, indicating that 67.8% of the occupational safety, health and sustainability (SHSE) Y variable is influenced by workers' knowledge, attitudes and actions. In comparison, the remaining 32.2% were influenced by other factors.

Table 7. Coefficient of Determination Test Result

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.832[a]	.692	.678	1.83505

a. Predictors: (Constant), Predictors: (Constant), Worker Actions (X3), Worker Attitude (X2), Employee Knowledge (X1)
b. Dependent Variable: Security, Health Safety, and Sustainability (SHSE) (Y)

Table 8. F Test Result

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	643.371	4	160.843	47.765	.000[b]
	Residual	286.229	85	3.367		
	Total	929.600	89			

a. Dependent Variable: Security, Health Safety, and Sustainability (SHSE) (Y)
b. Predictors: (Constant), Worker Actions (X3), Worker Attitude (X2), Employee Knowledge (X1)

F test (simultaneous). The F test was used to determine whether variables X_1 and X_3 jointly influence Y. Thus, it can be concluded that the hypothesis is supported. Simultaneously, worker knowledge, attitudes, and actions significantly affect the SHSE when constructing the Becakayu toll road section II-A.

T test (partial). The t test determines the significance of each independent variable on the dependent variable, assuming that the other variables remain constant. This test is carried out by comparing the t-count value with the t-table. The basis for decision-making is as follows: (1) if H_0 is true, then the variable coefficient is considered insignificant; (2) if H_1 is true, then the variable coefficient is considered significant. The t test was used to test partial regression coefficients. The t test results are displayed in Table 9.

Table 9. T test results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.236	2.502		-1.293	.199
	Employee Knowledge (X1)	.208	.074	.215	2.818	.006
	Worker Attitude (X2)	.308	.071	.305	4.333	.000
	Worker Actions (X3)	.419	.075	.404	5.551	.000

Table 9 provides the following explanation of the results of the multiple linear regression analysis:

1. The variable X_1 Worker Knowledge has a significant t value of 0.006 < 0.05, indicating that a significant influence variable exists. Worker knowledge significantly influences SHSE in the Becakayu Toll Road section II-A.
2. The variable X_2 Worker Attitude has a significant t value of 0.000 < 0.05, indicating that the variable has a significant influence. Worker Attitudes Workers significantly influence the SHSE on the Becakayu Toll Road section II-A.
3. The variable X_3 Worker Action has a significant t value of 0.000 < 0.05, indicating that the variable has a significant influence. Worker actions that have a significant impact on the SHSE in the Becakayu Toll Road section II-A.

3.2. Discussion

Based on the results of research hypothesis testing, it can be concluded that the worker knowledge variable has an effect on SHSE, the worker attitude variable has an effect on SHSE, and the worker action variable has an effect on SHSE because the statistic is above 1.96 and the significance value is <0.05.

Influence of Employee Knowledge on SHSE. Research hypothesis 1 shows the influence of worker knowledge factors on SHSE, with a significant t value of 0.006 < 0.05, indicating that the variable X_2 has a considerable influence. This finding implies that worker knowledge significantly influences the SHSE; hypothesis I can be accepted.

The research results above show that knowledge level influences workers' behavior regarding the SHSE. Work safety for workers must be prioritized. With respect to the knowledge and application of the SHSE to prevent accidents, environmental pollution, and work-related diseases, full support and attention must be received from leaders and management (ident prevention). Highly knowledgeable workers can more easily achieve the targets of implementing SHSE, namely, the targets of occupational health and safety, protecting workers, safeguarding company assets, and ensuring continuity of work and business (Lazuardi et al., 2022; Susanto et al., 2021). Testing hypothesis one shows that work knowledge significantly affects employee performance. This result is strengthened by the positive sign of the regression coefficient, which indicates that the better the worker's work knowledge is, the greater the worker's performance.

The Influence of Workers' Attitudes on SHSE. Hypothesis II predicts a relationship between workers' attitudes toward the SHSE and the highest level of influence. The analysis results show that worker attitudes have the greatest influence, as indicated by the t-statistic of 4.333 (>1.96). This means that workers' attitudes significantly influence SHSE, so hypothesis II is accepted. Workers' attitudes have the greatest influence on SHSE. It is important to pay attention to the behavioral aspects of workers who still consider SHSE behavior trivial or lack awareness and who are not disciplined in working on projects. Improving the work ethic and behavior of individuals in the SHSE must be prioritized, even though doing so is not easy. Therefore, SHSE management and safety officers need to have a strong commitment to consistently emphasize the importance of compliance and implementation of SHSE for worker safety. The observation results show that workers' attitudes are shaped by their knowledge, thoughts, beliefs and commitment, which both workers and management influence. If workers have sufficient knowledge but their attitudes are not consistent with that knowledge, implementing SHSE will not be effective. These findings are supported by the findings of Kartikasari and Sukwika (2021) and Sulistyowati and Sukwika (2022), who showed that workers' attitudes are positively and significantly related to their intention to comply with safety, occupational health and environmental policies through the use of personal protective equipment (PPE).

Influence of Employee Action on SHSE. This research showed that worker actions influence the SHSE, the third-highest score. According to the results of the t-statistic value of 5.551 (>1.96), worker actions have the third largest influence. This means that workers' actions significantly influence the SHSE, so hypothesis III is accepted. The results of the research above show that workers' actions influence their behavior regarding the SHSE.

When performing their jobs, workers should minimize the risk of workplace accidents by taking steps to use personal protective/safety equipment (PPE) and be behaviorally aware of occupational safety and health (OSH). In the project, the problems caused by workers in terms of work accidents are carelessness at work and indifference. The observation results indicated that many workers were familiar with the regulations but needed to carry out them. An example that is often found is that when workers have to use protective equipment such as gloves or protective clothing, they neglect to use it because it makes them uncomfortable. Workers' attitudes toward unsafe practices can impact worker safety in the workplace. Another causal factor

that drives the rate of work accidents is a lack of worker awareness and inadequate worker quality and skills. Research by Baka et al. (2022), Lazuardi et al. (2022), and Purwanti et al. (2023) shows that positive employee actions in implementing the SHSE program are related to employee commitment to the company.

3. Conclusion

Highly knowledgeable workers are aware of behaving about the SHSE and more easily achieve the SHSE goals: occupational health and safety targets for other people, protecting company assets, protecting workers and ensuring continuity of work. Workers' attitudes toward SHSE are the main priority for improvement, namely, increasing disciplined work ethic and SHSE behavior through strong management commitment, protecting company assets, protecting workers, and ensuring work continuity. Increasing employee understanding and awareness is important, especially when employees comply with and implement SHSE for worker safety. The SHSE program guarantees safety and reduces the risk of work accidents through efforts to control this risk through the provision of PPE. The suggestions for this research include the following: (1) Implementing the SHSE program must be based on commitment and awareness from company management and employees. (2) Management must establish an SHSE as a policy integral to other project activities. (3) Company management must provide refresher occupational safety and health education to increase the knowledge and ability to prevent workplace accidents that behave safely from the threat of danger.

Conflict of interest

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Author contributions

Tatan Sukwika: Conceptualization, Methodology, Supervision, Writing, Reviewing and Editing.

Amud Zabhara: Data curation, Writing draft preparation, Software, Validation.

References

- Alma, B. R., & Sunarto. (2007). Introduction to Statistics for Research: Education, Social, Communication, Economics and Business. Alphabeta.
- Arya, P. N. S., Widyaningsih, N., & Bintoro, P. K. (2020). Influence of Workers Performance to Implementation of Security, Safety, Health, and Sustainability. International Journal of Engineering & Technology, 9(2), 520. https://doi.org/10.14419/ijet.v9i2.30654
- Baka, K. S., Sukwika, T., & Maharani, M. D. D. (2022). Analisis pengaruh keselamatan dan kesehatan kerja terhadap kinerja karyawan di PT. Virtue Dragon Nickel Industry Konawe. Syntax Literate: Jurnal Ilmiah Indonesia, 7(11), 17877-17896. https://jurnal.syntaxliterate.co.id/index.php/syntax-literate/article/view/12634/7851
- Ghozali, I. (2019). Multivariate Analysis Application with the IBM SPSS 25 Program.
- Irianto, D., Basriman, I., & Sukwika, T. (2022). Pengembangan model metode HIRADC dalam analisis risiko bekerja di ketinggian pada proyek konstruksi PT. X di Jabodetabek. Journal of Industrial Hygiene and Occupational Health, 7(1), 53-68. https://doi.org/10.21111/jihoh.v7i1.8114

- Juarsa, D., Erislan, E., & Sukwika, T. (2023). Pengaruh penerapan safety culture melalui program indirect injury free terhadap kinerja keselamatan kesehatan kerja dan penyakit akibat kerja pada karyawan perusahaan gas. Malahayati Nursing Journal, 5, 8. https://doi.org/10.33024/mnj.v5i8.10630
- Kartikasari, S. E., & Sukwika, T. (2021). Disiplin K3 melalui pemakaian alat pelindung diri (APD) di laboratorium kimia PT sucofindo. VISIKES: Jurnal Kesehatan Masyarakat, 20(1), 41-50. https://doi.org/10.33633/visikes.v20i1.4173
- La, S., & Chaiddir, H. M. (2022). The Influence of OSH on the Behavior of Construction Workers in the Um Buton Building Construction. Jurnal Simki Economic, 5(2), 146–154. https://doi.org/10.29407/jse.v5i2.150
- Lazuardi, M. R., Sukwika, T., & Kholil, K. (2022). Analisis manajemen risiko keselamatan dan kesehatan kerja menggunakan metode HIRADC pada departemen assembly listrik. Journal of Applied Management Research, 2(1), 11-20. https://doi.org/10.36441/jamr.v2i1.811
- Lensun, G. B. T., Ingkiriwang, R. L., Tjakra, & Jermias. (2022). Analysis of Occupational Health Safety and Environmental Risks using the HIRADC Method in the Bridge and Oprit Boulevard II Construction Project. Tekno, 20(8), 1-12. https://ejournal.unsrat.ac.id/v3/index.php/tekno/article/view/44351/40449
- Mudzakir, A. M., Sukwika, T., & Erislan, E. (2023). Implementation of Mining Safety Management System and Impact of Drilling Operational Accident at PT Indodrill Banyuwangi. Jambura Journal of Health Sciences and Research, 5(1), 139-151. https://doi.org/10.35971/jjhsr.v5i1.17154
- Mustofa, B., Paranita, E. S., & Sukwika, T. (2023). Manajemen risiko dengan metode FMEA di instalasi gawat darurat rumah sakit Kuwait. Management Studies and Entrepreneurship Journal (MSEJ), 4(6), 1-12. https://www.yrpipku.com/journal/index.php/msej/article/download/2564/1828
- Notoatmojo. (2014). Health Behavior Science.
- Purwanti, N. H., Basriman, I., Sugiarto, S., & Sukwika, T. (2023). Pengaruh lingkungan kerja dan keselamatan kesehatan kerja terhadap kinerja karyawan pada PT. Changshin Reksa Jaya Garut Jambura Journal of Health Sciences and Research, 5(2), 602-613. https://doi.org/10.35971/jjhsr.v5i2.18928
- Sánchez, F. A. S., Peláez, G. I. C., & Alís, J. C. (2017). Occupational safety and health in construction: a review of applications and trends. Industrial Health, 55(3), 210-218. https://doi.org/10.2486/indhealth.2016-0108
- Soeharto, I. (2016). Project Management, From Conceptual to Operational. Erlangga.
- Sugiyono. (2019). Quantitative, Qualitative and R&D Research Methods. Alfabeta.
- Sukwika, T. (2023a). Menentukan Populasi dan Sampling. Metode Penelitian (Dasar Praktik dan Penerapan Berbasis ICT). Mifandi Mandiri Digital.
- Sukwika, T. (2023b). Variabel dan Hypotesis. Metode Penelitian Kuantitatif (Teori dan Panduan Praktis Analisis Data Kuantitatif). Mifandi Mandiri Digital.
- Sulistyowati, E., & Sukwika, T. (2022). Investigasi kecelakaan kerja akibat alat pelindung diri menggunakan metode SCAT dan Smart-PLS. Jurnal Ilmu Kesehatan Bhakti Husada: Health Sciences Journal, 13(1), 27-45. https://doi.org/10.34305/jikbh.v13i1.367
- Susanto, A., Maharani, M. D. D., & Sukwika, T. (2021). Evaluasi penerapan program "peka perisai" (studi kasus bagian pemboran dan WOWS PT. Pertamina EP asset V). Jurnal Migasian, 5(2), 21-33. https://doi.org/10.36601/jurnal-migasian.v5i2.172
- Utami, H. A., Istiqomah, Fardani, Sukmana, & Auliya. (2020). Qualitative & Quantitative Research Methods. Yogyakarta Group Science Library.

- Wary, M. C. P., Sukwika, T., & Prinajati, P. D. (2023). The suitability analysis of the occupational safety and health management system (OSHMS) application at the Budhi Asih Jakarta hospital. Journal of Applied Management Research, 3(1), 19-25. https://doi.org/10.36441/jamr.v3i1.1567
- Yuvendra, I., Sukwika, T., & Ramli, S. (2022). Occupational risks of firefighters in Jakarta: Job safety analysis approach. International Journal of Innovation in Engineering, 2(4), 60-65. https://www.ijie.ir/index.php/ijie/article/download/89/112