An Evaluation of Occupational Health and Safety (OHS) Implementation by the HSE Team on Construction Workers' Safety Perception and Work Motivation

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ABSTRACT

Occupational Health and Safety (OHS) is a crucial aspect in the construction sector, particularly in high-rise building projects that carry high risks of accidents and reduced worker motivation. This study aims to evaluate the implementation of OHS by the Health, Safety, and Environment (HSE) team on workers' safety perception and work motivation, with a case study on the BRI Building Project in Semarang conducted by PT. PP (Persero) Tbk. The research employed a quantitative approach with a correlational design and a cross-sectional method. Data were collected through questionnaires distributed to 76 respondents consisting of supervisors, staff, and construction workers. The research instrument was tested for validity and reliability, with a Cronbach's Alpha value of 0.886, indicating excellent internal consistency. Statistical assumption tests showed that the data were normally distributed; however, the linearity test indicated a significant relationship with deviations from linearity, leading to the use of Spearman's correlation analysis, with Pearson's correlation used as a comparison. The analysis results revealed a very strong, negative, and significant relationship between the role of HSE and work motivation (Spearman: $r = -0.991$; Pearson: $r = -0.999$; $p < 0.01$). These findings suggest that strengthening the role of HSE does not always directly increase worker motivation, as it is influenced by non-technical factors such as communication, safety culture, and trust in management. This study provides theoretical contributions by enriching the discussion of HSE's non-technical roles in fostering safety culture, as well as practical contributions for contractors in designing more comprehensive OHS management strategies.

Keywords: OHS, HSE, safety perception, work motivation, construction project.

INTRODUCTION

Building construction is a strategic sector in infrastructure development because it provides support facilities for social, economic, and environmental activities. Infrastructure not only supports economic growth, but also acts as a catalyst that affects the quality of life of the community. Data from the Global Infrastructure Outlook Report shows that global construction output grew by an average of 4.2% in 2018–2019, rising to 6.2% in 2021, and is expected to remain high in 2025 at 4.9%[[1]. Infrastructure development is generally divided into several main areas, such as highway construction, bridges, transportation networks, energy and water facilities, and building construction[2], with a notable trend in the construction of high-rise buildings in urban areas[3]. The construction of high-rise buildings has consequences in the form of increased work complexity and the risk of workplace accidents. Data from the Ministry of Manpower shows that national accident claims rose from 370,747 cases in 2023 to 462,241 cases in 2024, with the construction sector contributing ±4,233 cases per year (~1.1%)[4]. Globally, high-rise building projects account for up to 45% of accidents[5], with 26% of incidents caused by falls from heights, 12% by collisions with hard objects, and 9% by being struck by materials This high risk not only reflects the challenges of the OSH system but also impacts workers' psychological conditions, leading to anxiety, stress, decreased motivation, and reduced productivity. In Indonesia, OSH aspects are regulated through Ministry of Public Works and Public Housing Regulation No. 10 of 2021 concerning Guidelines for the Construction Safety Management System [6]. This regulation emphasizes the importance of technical safety standards, worker health, and protection for the community and project environment, making the implementation of the HSE team's role crucial to minimize accident risks while maintaining work motivation in the field.

Various regulations and occupational safety management systems have been implemented by the government and companies through the role of HSE (Health, Safety, and Environment). However, implementation in the field still faces challenges, especially regarding workers' perceptions and compliance with OSH standards. Factors such as operational obstacles, communication, low competence, suboptimal use of PPE, weak reporting procedures, and minimal risk awareness are the causes of low compliance, resulting in a gap between policy and practice[9] [10] [9]. PT. PP (Persero) Tbk is one of the largest state-owned construction companies in Indonesia that focuses on the construction of high-rise buildings. The company is known for its excellence in project management, structural innovation, and the implementation of occupational health and safety (OHS) systems. The role of HSE at PT. PP is realized through intensive training, control of risky activities with work permits, and consistent field supervision to create a safe and high-standard work environment[10].

According to Aslah Areiga, Indonesia Safety Center (2024), the role of Health, Safety, and Environment (HSE) is crucial in ensuring safety, occupational health, and environmental protection in construction projects[11]. Recent studies confirm that the implementation of a comprehensive safety management system, including HSE policies, systematic training, field audits, and enforcement of compliance, can significantly improve safety performance[12], [13] If the HSE team is able to carry out these functions consistently, then in addition to creating a safe work culture, it can also build trust and comfort among workers [14]. Trust in the safety system contributes directly to increased work motivation, because a safe work environment improves worker morale and active participation. Research by Putri et al. (2025) even shows that workers' perceptions of a safe work environment have a direct impact on motivation and productivity [15]. This confirms that the implementation of OSH not only has implications for physical safety but is also closely correlated with psychological aspects, including workers' motivation in completing projects.

Previous research on the implementation of occupational safety and health (OSH) in the construction sector has predominantly emphasized technical aspects, such as accident prevention and compliance with safety procedures. Saputra et al., 2023[16] emphasize the importance of compliance with the use of personal protective equipment (PPE) in reducing accident rates. Meanwhile, Niswatun Najihah et al., 2025 highlight the effectiveness of safety procedures in improving worker compliance in the field[[17] highlight the effectiveness of safety procedures in improving worker compliance. These studies contribute to strengthening the technical dimension, but are still limited in examining the active role of the HSE team in shaping safety perceptions and work motivation, especially in high-rise building projects in Indonesia. Most previous studies have focused more on the manufacturing, mining, or construction sectors in general, without specifically looking at the complexity of building projects. This indicates a research gap in examining the involvement of HSE teams in improving workers' safety perceptions and work motivation in construction. Therefore, there is still a research gap in examining how the involvement of HSE teams contributes to the formation of safety perceptions and work motivation among construction workers.

Based on these conditions, this study aims to evaluate the implementation of K3 by the HSE team on safety perceptions and work motivation with a case study on the construction project of the BRI Semarang Building, PT. PP (Persero) Tbk. Theoretically, this study contributes to the development of studies on the non-technical role of the HSE team in building a safety culture in the construction sector. Practically, the results of this study are expected to serve as a reference for contractors and stakeholders in designing more effective occupational safety management strategies, not only from a technical perspective, but also through the formation of positive perceptions and worker motivation. Performance indicators and the role of HSE in the implementation of K3 are important benchmarks for assessing the effectiveness of safety systems in the field. Therefore, this study measures how HSE implementation is related to safety perceptions and work motivation of construction workers through a quantitative approach using a questionnaire instrument. Several indicators used to measure the performance of the HSE team can be seen as follows :

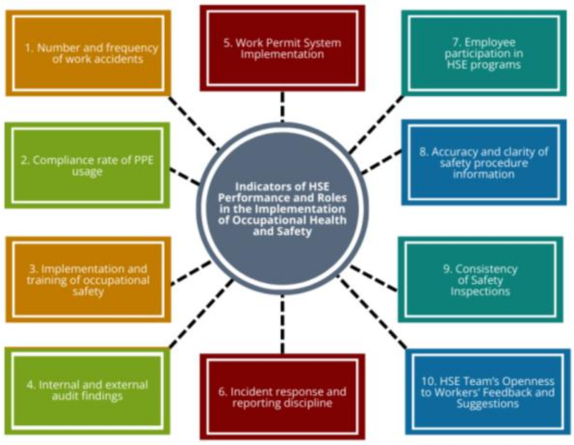

Figure 1. Performance indicators and the role of HSE in implementing K3

Research conducted by Suherdin & Aditya, 2022 shows that indicators such as Incident Rate (IR) and Frequency Rate (FR) are the main benchmarks in measuring workplace safety performance An $IR > 1.1$ and $FR \geq 10$ systematically indicate high workplace risks and are therefore used as the basis for assessing the effectiveness of HSE management systems. (2) Compliance with the use of personal protective equipment (PPE). Compliance with PPE usage is a valid and significant HSE performance indicator. This compliance is closely related to field supervision and the level of worker knowledge regarding safety procedures[18] [19]. (3) Implementation and training of occupational safety, the implementation and effectiveness of K3 training at PT. IHM, more than 90% of respondents stated that the training was effective in increasing K3 awareness and reducing work accidents, indicating that training is one of the important benchmarks in HSE performance[20]. (4) Findings from internal and external audits. Consistent implementation of internal audits in recording and analyzing OSH procedure violations has proven to support the achievement of zero accidents, making the number and type of audit findings a key indicator of the effectiveness of the occupational safety system[21]. (5) Implementation of the Work Permit System. The implementation of the Permit to Work System in high-risk jobs has been proven to significantly reduce potential hazards, confirming its effectiveness as part of the OSH risk control indicators[22], [23], [24]. (6) Response to incidents and reporting discipline. A study conducted by Chan et al., 2023 emphasizes that an incident-based organizational learning system that includes incident identification, reporting, investigation, root cause analysis, and implementation of corrective actions has a significant impact on reducing accidents and the severity of incidents in construction projects[25]. (7) Worker participation in HSE programs, the implementation of occupational safety programs significantly reduces unsafe worker behavior, indicating that their active participation in HSE programs is a valid performance indicator[26]. These indicators serve as benchmarks for evaluating the effectiveness of the OSH system implementation by the HSE team in supporting the achievement of occupational safety targets and the overall success of project implementation. (8) Clarity and accuracy of safety procedure information, a study by Cong et al., 2022 emphasizes the importance of clarity in safety communication: workers who encounter ambiguous information tend to seek clarification from colleagues[27]. A valid informal communication scale measures aspects such as self-needed communication (seeking information when there is uncertainty) and citizenship communication (the initiative to share safety information). This research shows that clear and available information has a direct impact on safe behavior in the field. (9) Consistency of safety inspections, safety inspections conducted routinely with checklists and standardized rating tools strengthen field supervision and accountability for the implementation of OSH procedures. Consistency of internal inspections is linked to a decrease in safety non-compliance incidents[13].(10) The openness of the HSE team to criticism and input from workers, clear and consistent safety communication, and openness to feedback are key mediators in improving worker safety performance . HSE openness to input from workers strengthens the effect of safety culture on safe behavior[28].

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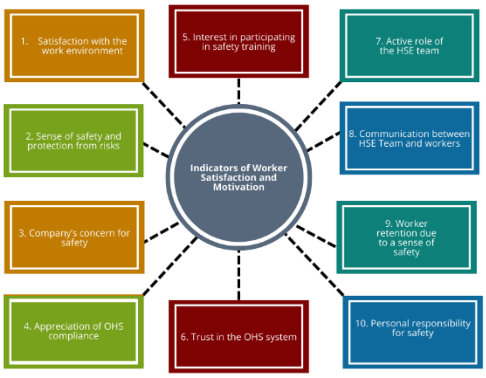

Figure 2. Indicators of employee satisfaction and motivation

Indicators of employee satisfaction and motivation can be measured from (1) Satisfaction with the work environment and workplace safety culture, which includes a safe physical environment, the availability of safety protocols, and effective leadership, contribute significantly to employee job satisfaction [29]. (2) Sense of security and protection from risks. A study conducted by Rarindo & Satata, 2021, confirms that work safety behavior moderates the relationship between motivation and job satisfaction [30]. In other words, safe behavior triggered by a sense of security increases the satisfaction and motivation of construction workers. (3) Company concern for safety, management commitment to safety, including the provision of safety resources and the ability to respond to accidents, is positively correlated with project safety performance. Implication: the company's commitment to safety also strengthens worker loyalty and motivation[31]. (4) Appreciation for K3 compliance. A systematic study by Imran & Ghazwan, 2025 concluded that appreciation and recognition of positive behavior in the workplace increases intrinsic and extrinsic motivation, improves job satisfaction, and reduces turnover[32]. Although not specific to the construction sector, this concept is relevant in emphasizing that appreciation for K3 compliance strengthens loyalty and work enthusiasm. (5) Interest in participating in safety training, research conducted by Tezel et al., 2021 shows that factors such as positive perceptions of training and hands-on training significantly increase the effectiveness of training, as well as trigger worker motivation and learning to comply with safety procedures in the field [33]. *Work engagement is triggered by workers' interest in safety training programs acting as a strong mediator between training and safety compliance and safety participation* [34]. (6)

Trust in the OSH system. A study by Ordysinski, 2024 shows that workers' trust in safety management significantly affects compliance with OSH regulations and *safety citizenship behavior* (SCB) and has been proven to have a full mediating effect on increasing SCB and reducing work accidents[35]. (7) Active role of the HSE team, a study by Zhang et al., 2023 highlights the safety management behavior of project owners (Owners' Safety Management Behavior), including safety communication, coordination, and resource allocation, which has been proven to increase proactive worker behavior such as proposing improvements and participating in safety activities (safety citizenship behavior)[36]. These findings illustrate how the active role of the HSE team and project leaders shapes a safety culture that encourages worker engagement. (8) HSE Communication and Workers: Key communication factors (management communication style, external motivation, safety information visibility) determine the success of risk control and worker well-being [37]. (9) Worker Retention Due to Safety: Research by Balogun et al., 2020 shows that a positive safety climate and attention to safety play an important role in strengthening the retention of construction project workers[38]. (10) Personal responsibility for safety, research by Mo et al., 2023 shows that workers with proactive personalities tend to have high self-efficacy in terms of safety (safety self-efficacy), which encourages them to be more active in carrying out safety behaviors, both in the form of compliance and participation[39]. This indicates that a sense of personal responsibility for safety is an important factor that motivates workers to actively engage in creating a safe work environment.

In response to the challenges of implementing K3 in the field, especially in high-risk jobs, a number of national construction companies such as PT PP (Persero) Tbk have developed a systematic safety-based managerial approach, namely through the application of the "10 Golden Rules of Critical Activities". These ten rules cover mandatory operational standards designed to control risks in work activities such as working at heights, lifting loads, excavation, electrical work, confined spaces, and work with fire potential. Each rule requires a work permit process, risk identification, worker certification, and the availability of safety equipment, as well as active supervision from the HSE team. This approach not only emphasizes procedural compliance, but also promotes two-way communication, routine training, and enforcement of work discipline to foster a positive perception of safety among workers. In this context, the HSE team not only acts as a technical supervisor, but also as an agent for shaping a safe and productive work culture. However, the effectiveness of this approach in shaping safety perceptions and influencing worker motivation has not been extensively researched, particularly in the context of high-rise building projects in Indonesia. Therefore, this study is important to assess the relationship between the implementation of the Golden Rules by the HSE team and perceptions and work motivation as part of efforts to strengthen a sustainable safety culture.

RESEARCH METHODS

Materials

Research methodology is a set of methods, steps, and strategies that researchers use systematically to obtain valid data, analyze it, and draw conclusions to answer or test hypotheses. This methodology includes the selection of the type of research, the approach used, the determination of the population and sample, the instruments used, data collection techniques, and data analysis methods. With a research methodology, the research process becomes more focused, measurable, and scientifically accountable so that the results obtained are objective and reliable. The stages of the research process carried out by researchers can be seen in the following figure.

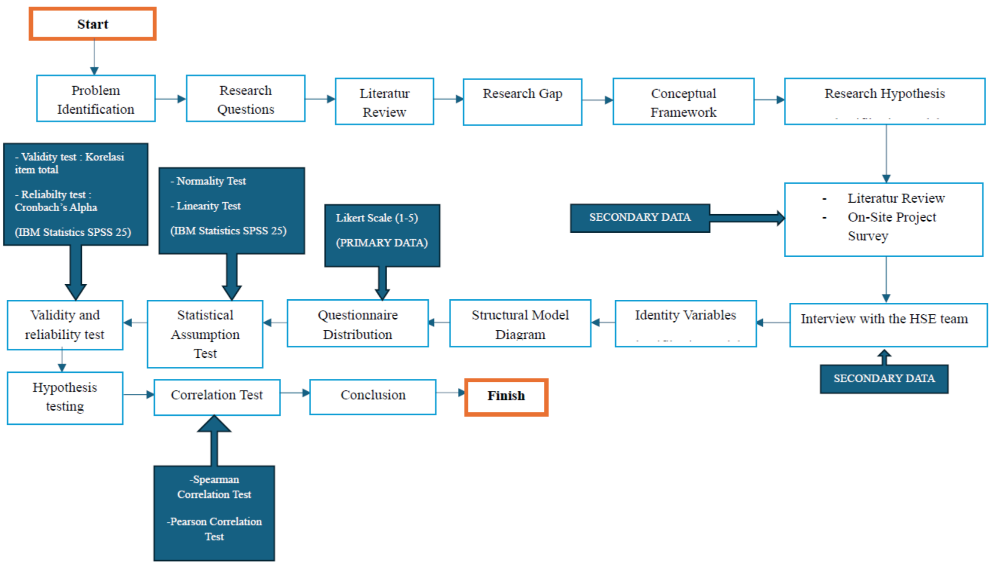

Figure 1. Path Diagram

Methods

This study uses a quantitative approach with a correlational design and cross-sectional method. A correlational design is a quantitative method that aims to identify relationships between variables. This design is not intended to confirm a cause-and-effect relationship, but rather to see whether there is a significant correlation. A correlational design can be conducted cross-sectionally or

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longitudinally, with the support of valid and reliable instruments[40]. In this study, the researcher used a cross-sectional method to collect data at a single point in time, which was effective for identifying patterns or prevalence in the population. Therefore, the researcher needed to pay close attention to the details of the research design and the selection of appropriate statistical analysis techniques so that the results obtained not only described the conditions at a single point in time but also had stronger validity and reliability to support the interpretation of the research findings [41]. Relationship analysis typically uses Pearson or Spearman coefficients to measure the direction and strength of the relationship between variables. The research instrument was a questionnaire compiled using a five-point Likert scale, with answer categories ranging from "strongly disagree" (1) to "strongly agree" (5).

Data collection was conducted directly by researchers through the distribution of questionnaires at the research location, namely the BRI Building construction project in Semarang City, which is under the auspices of PT. PP (Persero) Tbk. The research population included all project personnel, consisting of the HSE team, staff, supervisors, and workers. From this population, a total of 76 respondents were obtained, all of whom were involved as research samples. The data collection process was carried out over a period of three months, from June to August 2025.

Data Analysis

Data analysis in this study was conducted in several stages. First, statistical assumption tests were conducted, including normality and linearity tests to ensure that the data met the requirements for parametric analysis. Second, instrument validity was tested through item-total correlation and reliability testing using Cronbach's Alpha to measure the internal consistency of the questionnaire. Third, hypothesis testing was performed using *a paired sample t-test* to see significant differences or relationships between variables. Fourth, descriptive analysis was performed in the form of calculating the mean, standard deviation, minimum value, and maximum value for each variable. Fifth, Pearson's correlation test was conducted to determine the strength of the relationship between variables, as well as simple linear regression analysis to measure the effect of independent variables on dependent variables. The entire data analysis process was carried out using IBM SPSS Statistics software version 25.

RESULT AND DISCUSSION

From the results of the questionnaire distribution to supervisors, staff, and workers on the BRI Building construction project in Semarang City, responses were obtained from 76 respondents. Based on education level, there were 6 respondents (8%) with elementary school education, 13 respondents (17%) with junior high school education, 34 respondents (45%) with high school/vocational school education, 3 respondents (4%) with diploma education, and 20 respondents (26%) with bachelor's degree education. In terms of age, the majority of respondents were in the 20-30 age group, totaling 32 people (42%), followed by the 31-40 age group with 24 people (32%), the 41-50 age group with 18 people (24%), and the 51-60 age group with 2 people (3%). In terms of length of employment, most respondents, namely 52 people (68%), had 1–5 years of work experience, followed by 10 people (13%) with 6–10 years of experience, and 14 people (18%) with 11–20 years of experience.

Table 1. Respondent Profile

Education	**Frequency**	**Percentage (%)**
Elementary school	6	8
Junior High School	13	17
High School/ Vocational	34	45
Diploma	3	4
Bachelor	20	26
Age (years)		
20 – 30	32	42
31 – 40	24	32
41 – 50	18	24
51 - 60	2	3

Education	Frequency	Percentage (%)
Years of Service		
< 5 years	52	68
6 – 10 years	10	13
11 – 20 years	14	18

It can be concluded that the majority of respondents have a high school/vocational school educational background, are in the 20–30 age group, and are relatively new to the construction industry with an average work experience of less than 5 years.

Statistical Assumption Test

a. Normality test

Table 2. Normality test

Test of Normality						
	Kolmogrov-Smirnov[a]			Shapiro-Wilk		
	Statistics	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Variable X	.065	76	.200*	.969	76	.056
Variable Y	.071	76	.200*	.970	76	.065

a. Liliefors Significance Correction

The normality test in this study was conducted to determine whether the distribution of variable X (HSE team performance in implementing K3) and variable Y (worker satisfaction/motivation) followed a normal distribution or not. The test was conducted using two approaches, namely the Kolmogorov-Smirnov and Shapiro-Wilk tests. The Kolmogorov-Smirnov test results showed a significance value of 0.200 for variable X and 0.200 for variable Y. Meanwhile, the Shapiro-Wilk test produced a significance value of 0.056 for variable X and 0.065 for variable Y. All significance values were > 0.05. Thus, the null hypothesis (H_0), which states that the data is normally distributed, is accepted[42]. This means that the normality assumption is satisfied, so that hypothesis analysis can be continued using parametric statistical techniques.

b. Linearity Test

Table 3. Linearity test using ANOVA table

ANOVA Table			Sum of Squares	df	Mean Square	F	Sig.
Variabel Y*Variabel X	Beetwen Groups	**(Combined)**	593.861	16	37.116	2.383	.008
		Linearity	102.240	1	102.240	6.564	.013
		Deviation from Linearity	491.621	15	32.775	2.104	.022
	Within Groups		918.929	59	15.575		
	Total		1512.789	75			

Based on the results of the linearity test between variable X and variable Y, a *Sig. Linearity* value of 0.013 (< 0.05) was obtained, indicating that there is a significant relationship between the independent variable and the dependent variable. However, the *Sig. Deviation from Linearity* value of 0.022 (< 0.05) indicates a deviation from linearity. Thus, the relationship between the independent variable and the dependent variable is not entirely linear, so a simple linear regression model is not appropriate for describing the relationship between the two variables.

These findings confirm that the relationship between X and Y is significant, but not entirely linear. This condition suggests that other analytical approaches such as non-linear regression or variable transformation may be considered in order to produce a more appropriate model. These non-linear results indicate that improvements in HSE performance are not always directly proportional to increases in worker motivation. The complexity of non-technical factors in the field, such as inter-worker communication, safety culture, level of trust in management, and individual psychological conditions, can influence this relationship. Therefore, these findings suggest the need for alternative analytical approaches, either through non-linear regression or variable transformation, so that the

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resulting model is better able to capture the actual dynamics occurring in the construction work environment.

Validity and Reliability Test

a. Validity Test: total item correlation
Validity is a measure that indicates the level of validity or validity of an instrument. The results of the validity test of the research instrument using Pearson's correlation (product moment) between each statement item (P01–P20) and the total score show that most items have a significant correlation value at the 5% level (Sig. < 0.05) and a correlation coefficient greater than 0.30. This means that these items are valid because they are able to measure the intended construct. Of the 20 statement items tested, 19 items were proven to be valid, namely P01, P02, P03, P04, P05, P06, P07, P08, P09, P10, P11, P12, P13, P14, P15, P16, P17, P18, P19, and P20. Thus, the research instrument used can be declared valid.

b. Reliability test: *Cronbach's Alpha*
Used to test the reliability of a research instrument. A questionnaire is considered reliable if a person's answers to questions are consistent or stable over time. Note that *Cronbach's alpha* value must be > 0.70.

Table 4. Reliability Test

Reliability Statistics	
Cronbach's Alpha	N of Items
.886	20

The results of the research instrument reliability test show that the Cronbach's Alpha value is 0.886 with a total of 20 items. This value is in the very high category because it exceeds the minimum reliability limit of 0.70. This indicates that the research instrument has good internal consistency and can be trusted for use in data collection. The reliability of the research instrument is determined based on the Cronbach's Alpha value. If the Cronbach's Alpha value is greater than 0.70, the instrument can be declared reliable because it has good internal consistency. Conversely, if the Cronbach's Alpha value is less than 0.70, the instrument is considered unreliable and unsuitable for use in collecting research data[43].

Hypothesis Testing: Correlation Test

Hypothesis testing was conducted using Spearman's correlation analysis because the data showed a non-linear relationship. Pearson's test was also conducted as a comparison to see the consistency of the results. As an additional test, Pearson's correlation test was also conducted because the data was normally distributed as a companion and comparison.

a. Spearman Correlation Test

Table 5. Spearman Correlation Test Table

Correlations				
			Variable X	Variable Y
Spearman's rho	X	Correlation Coefficient	1.000	-.991**
		Sig. (2-failed)		.000
		N	76	76
	Y	Correlation Coefficient	-.991**	1.000
		Sig. (2-failed)	.000	
		N	76	76

**Correlation is significant at the 0.01 level (2-failed)

Based on the results of Spearman's correlation analysis, a correlation coefficient of -0.991 with a significance of 0.000 (< 0.01) was obtained. This indicates that there is a very strong, negative, and significant relationship between variable X and variable Y. These findings indicate that there is a very strong, negative, and significant relationship between variable X and variable Y, so H_0 is rejected and H_1 is accepted.

b. Pearson Correlation Test

Table 6. Pearson Correlation Test Table

Correlations			
		Variable X	Variable Y
X	Pearson Coefficient	1	-.999**
	Sig. (2-failed)		.000
	N	76	76
Y	Correlation Coefficient	-.999**	1
	Sig. (2-failed)	.000	
	N	76	76

**Correlation is significant at the 0.01 level (2-tailed)

Based on the results of Pearson's correlation analysis, a correlation coefficient of -0.999 was obtained with a significance level of 0.000 (<0.01). These results indicate a very strong, negative, and significant relationship between variable X and variable Y. This means that the higher the value of variable X, the lower the value of variable Y, and vice versa. Thus, the null hypothesis (H_0), which states that there is no relationship between variable X and variable Y, is rejected, while the alternative hypothesis (H_1) is accepted. This almost perfect negative correlation indicates that the relationship between the two variables is very close and consistent in the opposite direction.

The results of this study, which show a negative and significant relationship between the role of HSE and worker motivation, differ from the findings of Sunarjo & Amin (2025), who noted the positive influence of OSH implementation on work motivation. This difference can be explained by non-technical factors in the field, as emphasized by Thai & Hien (2025) and Ordysiński (2024), that safety culture and the level of worker trust in the management system play an important role in shaping workers' perceptions and motivational responses.

CONCLUSION

This study aims to evaluate the role of the HSE team in implementing occupational health and safety (OHS) and its relationship with workers' safety perceptions and work motivation in the construction project of the BRI Semarang Building by PT. PP (Persero) Tbk. A number of statistical tests were conducted to ensure the quality of the instruments and the accuracy of the analysis. The validity test showed that all questions were valid, while the reliability test produced a Cronbach's Alpha value above 0.70, indicating that the research instrument had good internal consistency and was reliable. Furthermore, the normality test showed that the data was normally distributed, while the linearity test showed a significant but not entirely linear relationship between the independent and dependent variables. This condition made Spearman's correlation analysis more appropriate to use, with the Pearson test run as a comparison. The Spearman correlation test results show a coefficient value of -0.991 with a significance of 0.000 (< 0.01), while the Pearson test produces a coefficient of -0.999 with a significance of 0.000 (< 0.01). Both results confirm a very strong, negative, and significant relationship between the role of HSE and worker motivation. This means that an increase in the role of HSE is not always followed by an increase in worker motivation, but is influenced by complex non-technical factors, such as communication, safety culture, trust in management, and psychological conditions in the field. Thus, it can be concluded that the effectiveness of the HSE role is not only determined by the technical implementation of OSH, but also by the ability to build a safety culture and strengthen the psychological factors of workers. Theoretically, this study enriches the study of the relationship between OSH, safety perceptions, and motivation in the context of high-rise building projects in Indonesia. Practically, these findings provide input for contractors and stakeholders to design a more comprehensive OSH management strategy, covering both technical and non-technical aspects.

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