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IMPROVING PROJECT PERFORMANCE THROUGH RISK COMMUNICATION AND RISK CONTROL IN BRIDGE CONSTRUCTION KLARI WATERFALL, KARAWANG

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Abstract

The success of a construction project is greatly influenced by the ability to manage risks effectively, particularly through risk communication and risk control. This study aims to analyze the influence of risk communication and risk control on project performance in the Curug Klari Bridge construction project in Karawang. The study used a quantitative approach with a survey method. Data were obtained through questionnaires distributed to parties involved in the project implementation and analyzed using multiple linear regression with the help of IBM SPSS Statistics version 26. The results indicate that risk communication has a positive and significant effect on project performance. Risk control also has a positive and significant effect on project performance. Furthermore, risk communication and risk control simultaneously have a positive and significant effect on project performance. These findings indicate that effective risk communication and consistent risk control can improve coordination, support decision-making, minimize the impact of risks, and encourage the achievement of project objectives. Therefore, the implementation of risk communication and risk control needs to be an integrated part of project management to improve construction project performance.

Keywords: Risk Communication, Risk Control, Project Performance, Risk Management, Construction Project.

INTRODUCTION

The construction industry is a strategic sector that plays a crucial role in supporting infrastructure development and economic growth. The success of a construction project is measured not only by completing work according to technical specifications, but also by achieving targets for time, cost, quality, and safety (Muafiq et al., 2021) . However, construction projects face a high level of uncertainty due to various factors, such as field conditions, design changes, material delays, weather, stakeholder coordination, and occupational safety risks. These conditions make risk management a crucial aspect in identifying, analyzing, and controlling risks to minimize negative impacts and improve project success and performance (Novianto et al., 2023) . In practice, various construction projects in Indonesia still face problems such as delays in work completion, cost overruns, decreased quality of construction results, and low coordination effectiveness between the parties involved (Hardiputra et al., 2025) . Most of these problems are related to suboptimal risk communication and risk control during project implementation. Risks that are not communicated in a timely manner can cause delays in decision-making, while risk control that is not carried out systematically has the potential to increase negative impacts on the achievement of project objectives (Song et al., 2025) .

Risk communication is the process of conveying and exchanging information regarding potential risks to all stakeholders so that all parties have a shared understanding of the risks faced and how to address them (Prasasto & Putra, 2024) . Meanwhile, risk control is the process of monitoring, evaluating, and implementing corrective actions against identified risks to ensure the effectiveness of the implemented mitigation strategies (Hudoyo & Purwono, 2023) . Both aspects are essential parts of the project risk management process and are believed to contribute to improved project performance. Many studies have been conducted on risk management to improve construction project performance, such as research by Johari & Fazriani (2022), which shows that the implementation of risk management through the process of identification, analysis, evaluation, and risk control plays a role in minimizing the impact of risks on construction projects. Effective risk management can improve project performance by controlling time, costs, work quality, and smooth project implementation. Furthermore,

research by Septianugraha et al. (2024) shows that from the perspective of service users (owners) , there are 11 risk variables **,** with 8 risks in the high risk category and 3 risks in the low risk category. medium risk . Meanwhile, from the service provider (contractor) point of view , 21 risk variables were found **,** with 18 risks in the high risk category **,** 2 risks in the medium risk category **,** and 1 risk in the low risk category. low risk **.** Research (Ramadhan et al., 2023) results of the study showed that there were 7 most dominant risks in the 'Unacceptable' category, namely the risk of environmental safety impacts on the project (8.7%), the influence of weather on construction activities (8.7%), inappropriate implementation methods (8.7%), uncertainty in the timing of ordering materials (8.7%), incorrect placement of workers who do not match their skills (8.7%), shortage of workers (8.7%), inappropriate scheduling (8.7%).

However, most research still discusses risk management in general or focuses solely on the risk identification and analysis process. Research specifically examining the impact of risk communication and risk control on project performance in bridge construction projects is still relatively limited, particularly in infrastructure projects at the regional level. Furthermore, the characteristics of each construction project are different , so research findings on building or road projects may not be generalizable to bridge projects. This research was conducted on the Curug Klari Bridge construction project in Karawang. This infrastructure project requires effective risk management due to the involvement of various stakeholders, the complex construction work, and the demands for completion within time, cost, quality, and safety targets. Therefore, an empirical study is needed to determine how risk communication and risk control contribute to improved project performance. Based on the description, this study aims to analyze the improvement of project performance through risk communication and risk control in the construction of the Curug Klari Karawang Bridge.

LITERATURE REVIEW

Construction Project Risk Management

Risk management is a systematic process for identifying, analyzing, evaluating, and controlling risks that have the potential to affect the achievement of project objectives (Nugroho & Purwanto, 2024) . In bridge construction projects, the implementation of risk management is very important because the work has a high level of complexity and uncertainty, especially in foundation and pile cap work (Hartono et al., 2024) . Based on ISO 31000:2018, the risk management process includes communication and consultation, context determination, identification, analysis, evaluation, treatment, and monitoring of risks (Chrisanty & Tambotoh, 2024) . The implementation of this process helps the project team determine appropriate control strategies to minimize the impact of risks on cost, time, quality, and safety (Kallow et al., 2023) . In bridge construction projects, common risks include material procurement delays, design changes, extreme weather conditions, structural difficulties, limited heavy equipment, incorrect implementation methods, and safety risks (Hartono et al., 2024) . If not managed properly, these risks can lead to delays in project completion, increased costs, decreased work quality, and compromised construction safety (Pagoray, 2022) .

Risk Communication in Construction Projects

Risk communication is the process of conveying information regarding potential risks, risk levels, and mitigation measures to all stakeholders in a project (Atasoy et al., 2022) . In bridge construction projects involving the project owner , contractor, supervising consultant, material suppliers, and labor, risk communication is a crucial factor in ensuring that all parties have a shared understanding of the project's conditions (Prasasto & Putra, 2024) . The effectiveness of risk communication can be seen from the clarity of information, the timeliness of information delivery, coordination between parties, and risk reporting mechanisms (Atasoy et al., 2022) . Poor communication can lead to delays in decision-making, errors in work execution, and increased risk impacts on the project (Peli et al., 2022) . Risk communication in this study was measured based on the opinion of (Peli et al., 2022) , namely, 1) Clarity of information, 2) Clarity of responsibility, 3) Coordination relationships, 4) Exchange of information and 5) Utilization of communication technology.

Risk Control in Construction Projects

Risk control is an action to ensure that identified risks can be reduced or controlled according to the project plan (Simanjuntak et al., 2022) . Control is carried out through the implementation of mitigation strategies for priority risks to minimize the potential for project failure and delays (Lestari & Pratiwi, 2023) . In construction projects, risk control plays a crucial role in maintaining the achievement of time, cost, and quality targets because delays in one activity can affect other activities (Hudoyo & Purwono, 2023) .

Risk control strategies can be implemented through risk reduction , risk avoidance , risk transfer , and risk acceptance (Septianugraha et al., 2024). The implementation of these strategies aims to minimize the impact of risks so that project targets for time, cost, quality, and safety can be achieved (Almutahir & Wiguna, 2024) . Risk control is measured using indicators (Almutahir & Wiguna, 2024) , namely 1) Regular risk monitoring, 2) Implementation of risk mitigation measures, 3) Evaluation of the effectiveness of risk control, and 4) Implementation of corrective actions against risks.

Construction Project Performance

According to Ervianto in (Mael et al., 2025) the success of a construction project is not only assessed by technical aspects, but also by the effectiveness of resource management and control. Risk. Project performance is generally used as a benchmark for the success or failure of construction projects. Project performance can be measured based on human resources, which are the most important aspect of a project's success (Sundara et al., 2024) . Project performance is a benchmark for the success of project implementation in achieving planned targets, both in terms of time, cost, quality, and work safety. According to Suharto (1999) Project performance is the result of project implementation measured based on the effectiveness of resource use, time achievement, cost, quality, and work safety (Silalahi et al., 2023) . Good project performance indicates that work is carried out effectively and efficiently according to plan, so that resource use can be optimally controlled and the risk of delays, cost overruns, and decreased work quality can be minimized. According to Nassar & Abourizk In (Safari et al., 2021) construction project performance can be measured using the indicators 1) time, 2) quality, 3) cost and 4) safety.

Framework

The success of a construction project is influenced by the effectiveness of risk management during project implementation. Poorly managed risks can lead to delays, cost overruns, quality degradation, and safety issues. Therefore, risk communication and risk control are critical factors in improving project performance. Effective risk communication supports coordination and decision-making, while risk control through monitoring, mitigation, evaluation, and corrective action aims to minimize the impact of risks. Therefore, the effective implementation of risk communication and risk control is expected to improve the performance of the Curug Klari Bridge construction project in Karawang, as measured by achieving targets for time, cost, quality, and safety.
Based on this description, the research framework can be described as follows:

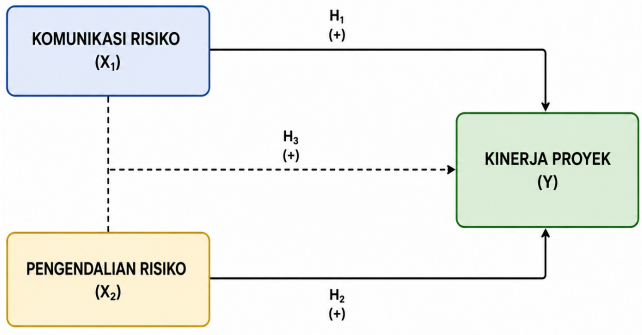

Figure 1. Framework of Thought

Research Hypothesis

H1: Risk communication affects project performance in the construction of the Curug Klari Karawang Bridge.
H2: Risk control affects project performance in the construction of the Curug Klari Karawang Bridge.
H3: Risk communication and risk control simultaneously influence project performance in the construction of the Curug Klari Karawang Bridge **.**

RESEARCH METHODS

This study uses a quantitative research method with an associative approach, an associative approach is an approach that aims to determine the relationship or influence between independent variables and dependent variables. The population in this study is all parties involved in the Curug Klari Karawang bridge construction project , the sampling technique used is saturated sampling, where all members of the population totaling 47 people are used as research samples.

The data sources in this study are primary data with instrument testing, classical assumption testing, multiple linear regression analysis and hypothesis testing, with data processing using SPSS software version 26.

RESEARCH RESULT

This section presents the results of data analysis and research discussion regarding improving project performance through risk communication and control in the construction of the Curug Klari Karawang Bridge.

Respondent Characteristics

Based on the results of a questionnaire collected from 47 respondents, data was obtained regarding the respondents' work experience background. Information on respondents' characteristics regarding their most recent education is explained in the following table:

Table 1. Work Experience

Work experience	Number of Respondents	
	Frequency	Percentage
< 3 Years	11	23.4%
3 - 5 Years	22	46.8%
5 - 10 Years	8	17.0%
> 10 Years	6	12.8%
Amount	47	100%

Source: Data Processing Results, 2026

Based on the results of a questionnaire survey of 47 respondents, the majority of respondents had 3-5 years of work experience with a percentage of 46.8%, and the fewest had work experience of > 10 years with a percentage of 12.8%. Based on the results of a questionnaire collected from 47 respondents, data was obtained regarding the respondents' most recent educational background. Information on the respondents' characteristics for their most recent education is explained in the following table:

Table 2. Last Education

Last education	Number of Respondents	
	Frequency	Percentage
High School	28	59.6%
Diploma	11	23.4%
S1	8	17.0%
Amount	47	100%

Source: Data Processing Results, 2026

The majority of respondents had a high school education (59.6%), followed by those with a diploma (23.4%), and those with a bachelor's degree (S1) in third place (17%).

Validity and Reliability Test

Data validity can be stated if it has a correlation coefficient or calculated r value > the product moment table r value at a significance level (α) of 5% or 0.05 (calculated r > table r). Testing produces validity in this research variable using the Pearson Correlation method as follows:

1. Risk Communication (X_1)

Table 3. Validity Test of Risk Communication Variable (X_1)

Statement	r count	r table	Information
X1-1	0.405	0.288	Valid
X1-2	0.373	0.288	Valid
X1-3	0.524	0.288	Valid
X1-4	0.680	0.288	Valid
X1-5	0 ,610	0.288	Valid
X1-6	0.570	0.288	Valid
X1-7	0.474	0.288	Valid
X1-8	0.573	0.288	Valid
X1-9	0.697	0.288	Valid
X1-10	0.657	0.288	Valid

The validity test above resulted in all questionnaire items on the risk communication variable (X1) having a calculated r value > the table r value (calculated r > table r), so that the entire questionnaire on the risk communication variable (X1) was valid.

2. Risk Control (X 2)

Table 4. Validity Test of Risk Control Variables (X1)

Statement	r count	r table	Information
X2-1	0.516	0.288	Valid
X2-2	0.412	0.288	Valid
X2-3	0.633	0.288	Valid
X2-4	0 ,480	0.288	Valid
X2-5	0.588	0.288	Valid
X2-6	0.608	0.288	Valid
X2-7	0.527	0.288	Valid
X2-8	0.421	0.288	Valid

Source: SPSS 26 output, processed 2026

The validity test above resulted in all questionnaire items on the risk control variable (X2) having a calculated r value > the table r value (calculated r > table r), so that the entire questionnaire on the risk control variable (X1) is valid.

3. Project Performance (Y)

Table 5. Validity Test of Project Performance Variable (Y)

Statement	r count	r table	Information
X1-1	0.405	0.288	Valid
X1-2	0.373	0.288	Valid
X1-3	0.524	0.288	Valid
X1-4	,680	0.288	Valid
X1-5	0 ,610	0.288	Valid
X1-6	0.570	0.288	Valid
X1-7	0.474	0.288	Valid
X1-8	0.573	0.288	Valid

Source: Processed data SPSS 26, 2026

The validity test above resulted in all questionnaire items on the project performance variable (Y) having a calculated r value > the table r value (calculated r > table r), so that the entire questionnaire on the project performance variable (Y) is valid. the Cronbach's Alpha coefficient for each analyzed variable. An instrument is considered reliable if the Cronbach's Alpha value is greater than 0.6. This test used the Cronbach's Alpha reliability coefficient technique assisted by SPSS version 26 software. The results of the reliability test are presented as follows:

Table 6. Reliability Test Results

Variables	Cronbach's Alpha	Information
Risk Communication (X 1)	0.853	Reliable
Risk Control (X 2)	0.803	Reliable
Project Performance (Y)	0.867	Reliable

Source: Processed data SPSS 26, 2026

The reliability test results above indicate that all research variables achieved a Cronbach's Alpha value > 0.60. Therefore, respondents' responses to all research variables were reliable, and all statement items could be used in the study.

Multiple Linear Regression Analysis

Multiple linear regression analysis was used to test the effect of independent variables on the dependent variable. Data analysis was performed using IBM SPSS Statistics version 26. The results of the multiple linear regression analysis are presented in Table 5 .

Table 7. Multiple Linear Regression Analysis

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8,463	3,460		-2,446	,019
	Risk Communication	,521	,052	,702	9,965	,000
	Risk Control	,608	,112	,383	5,436	,000
a. Dependent Variable: Project Performance						

Source: Data processing results , 2026

From the results in Table 7, the regression equation can be formulated as follows:

$$Y = -8,463 + 0.521X_1 + 0.608X_2$$

The constant (α) -8.463 means that if risk communication (X_1) and risk control have a value equal to 0 (zero) , then project performance (Y) has a value of -8.463. The regression coefficient of risk communication (X_1) of 0.521 , risk control (X_2) as big as 0.608 , all of which are positive. This indicates that an increase in each of these variables will improve project performance, with the greatest influence coming from the risk control variable (X_2) .

Coefficient of Determination

To calculate how much influence (contribution) is given overall, it can be known through the coefficient of determination, with the formula Kd = R^2 x 100% .

Table 8. Coefficient of Determination

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	,895 [a]	,801	,792	2,950
a. Predictors: (Constant), Risk Control, Risk Communication				
b. Dependent Variable: Project Performance				

Source: Data processing results , 2026

$$Kd = R^2 \times 100\%$$
$$= 0.895^2 \times 100\%$$
$$= 80.1\%$$

The analysis results show a coefficient of determination (R^2) of 0.801 , meaning 80.1% of project performance variability can be explained by risk communication and risk control variables . Meanwhile, the remaining 19.9% is influenced by other factors outside the research model.

Partial Hypothesis Testing (t-Test)

A partial hypothesis test (t-test) was conducted to examine the influence of each independent variable on the dependent variable. The results of the partial test using IBM SPSS Statistics version 26 are presented in Table 9.

Table 9. Partial Hypothesis Testing (t-Test)

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8,463	3,460		-2,446	,019
	Risk Communication	,521	,052	,702	9,965	,000
	Risk Control	,608	,112	,383	5,436	,000
a. Dependent Variable: Project Performance						

Source: Data processing results , 2026

The influence of risk communication on improving project performance in the construction of the Curug Klari Karawang bridge , based on Table 9, obtained a significant value of 0.000, where the value α= 0.05 , so that 0.000 < 0.05. Then the calculated t value of 9.965 and the t value table for the number of respondents 47 people, with a significance value of 0.05 of 2.0 12 , then the calculated t > t Table $_{1}$. Based on these data, it can be said that partially risk communication has a significant effect on improving project performance in the construction of the Curug Klari Karawang bridge . The influence of risk control on improving project performance in the construction of the Curug Klari Karawang bridge , based on Table 9, obtained a significant value of 0.000, where the value α= 0.05 , so that 0.005 < 0.05. Then the calculated t value of 5.436 and the t value table for the number of respondents 47 people, with a significance value of 0.05 of 2.0 12 , then the calculated t > t Table . Based on these data, it can be said that partially risk control has a significant effect on improving project performance in the construction of the Curug Klari Karawang bridge.

Simultaneous Hypothesis Testing (F Test)

A simultaneous hypothesis test (F test) was conducted to examine the influence of the independent variables on the dependent variable. The results of the simultaneous test (F test) using IBM SPSS Statistics version 26 are presented in Table 10.

Table 10. Simultaneous Hypothesis Testing (F Test)

ANOVA [a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1543,903	2	771,952	88,696	,000 [b]
	Residual	382,948	44	8,703		
	Total	1926,851	46			
a. Dependent Variable: Project Performance						
b. Predictors: (Constant), Risk Control, Risk Communication						

Source: Data processing results , 2026

The simultaneous influence of risk communication and risk control on improving project performance in the construction of the Curug Klari Karawang bridge , based on Table 10, obtained a significant value of 0.000, where the value α= 0.05 , so that 0.005 < 0.05. Then the calculated F value of 88.696 and the F table value for the number of respondents is 47 people, with a significance value of 0.05 of 3.21 , then the calculated F > F table . Based on these data, it can be said $_{that}$ simultaneously Risk communication and risk control have a significant influence on improving project performance in the construction of the Curug Klari Karawang bridge.

DISCUSSION

The test results show that all independent variables (risk communication and risk control) have an impact on variable Y (project performance). The analysis and test results are explained in more detail as follows:

The Influence of Risk Communication on Project Performance

The results of the study show that risk communication has a positive and significant effect on the performance of the Curug Klari Karawang Bridge construction project. These findings indicate that effective risk communication can improve coordination and collaboration among stakeholders, facilitate the delivery of information regarding potential risks, and support appropriate decision-making in project implementation. Therefore, the implementation of good risk communication contributes to the achievement of project targets in terms of time, cost, quality, and work safety. Therefore, the more effective the risk communication is, the better the resulting project performance will be.

The Impact of Risk Control on Project Performance

The results of the study indicate that risk control has a positive and significant impact on the performance of the Curug Klari Bridge construction project in Karawang. This finding indicates that effectively implemented risk control can minimize the impact of risks through the process of identification, monitoring, evaluation, and appropriate mitigation actions. Consistent implementation of risk control helps the project team respond quickly to various obstacles, maintains smooth work implementation, and supports the achievement of project targets in terms of time, cost, quality, and work safety. Therefore, the better the risk control implemented, the higher the resulting project performance.

Influence of Communication Risk and Control over Project Performance

The results of the study indicate that risk communication and risk control together have a positive and significant effect on the performance of the Curug Klari Karawang Bridge construction project. This finding indicates that effective risk communication and consistently implemented risk control complement each other in supporting the success of the project implementation. The delivery of appropriate risk information, supported by systematic control measures, can improve coordination, accelerate decision-making, and minimize the impact of risks on project implementation. Thus, the synergy between risk communication and risk control contributes to the achievement of project targets in terms of time, cost, quality, and work safety, thereby improving overall project performance.

CONCLUSION

This study proves that risk communication and risk control have an important role in improving project performance in the construction of the Curug Klari Bridge in Karawang. Partially, risk communication has a positive and significant effect on project performance, indicating that effective delivery of risk information can improve coordination, accelerate decision-making, and support the achievement of project objectives. Risk control also has a positive and significant effect on project performance, indicating that the systematic implementation of risk control measures can minimize the impact of risks and keep project implementation in line with predetermined targets. Simultaneously, risk communication and risk control have a positive and significant impact on project performance. These findings indicate that the implementation of effective risk communication accompanied by continuous risk control can increase the success of construction project implementation. Therefore, project managers need to strengthen risk communication mechanisms and consistently implement risk control as part of the project management strategy to optimally improve project performance.

Suggestion

Based on the research results, contractors and project management are advised to strengthen the implementation of risk communication through more effective coordination, timely delivery of risk information, and the involvement of all stakeholders in the risk management process. Furthermore, risk control needs to be carried out consistently through risk identification, monitoring, evaluation, and mitigation activities to minimize potential obstacles during project implementation. For future researchers, it is recommended to develop the research by adding other variables that have the potential to influence project performance, such as project leadership, occupational safety culture, human resource competency, or the use of project management technology, so that a more comprehensive research model is obtained.

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