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Analysis of Risk Factors on Implementation Performance Building Work in Palu City

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Abstract: A comprehensive study was conducted to determine the risk factors significantly impacting Palu City's building construction performance. A descriptive method was used, and 47 stakeholders involved in building implementation, including civil engineers, local government officials, and construction industry stakeholders, were surveyed. Multiple linear regression was used for data analysis. The results showed that four factors, namely management, finance, material, and labor, significantly influenced building work implementation. These factors are significant as they provide insights into the key areas that need attention in the construction industry in Palu City. Two regression equations showed the association between the factors and performance. According to the coefficient of determination test, 77% and 84% of the performance variability could be explained by the components found. This shows a strong relationship between these factors and the construction performance of building projects. In comparison, the remaining 23% and 16% were attributed to other factors not identified in the study. These findings suggest that the construction industry in Palu City needs to consider and manage the identified risk factors to improve the overall building construction project performance.

Keywords: *Factor; Risk; Performance; Building; Palu*

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I. INTRODUCTION

Building infrastructure in Palu still has a lot to be completed, including housing, office buildings, school and college buildings, hospital buildings, and others. Building infrastructure was constructed to support and restore the people's economy in Palu City due to the earthquake, liquefaction, and tsunami disaster in 2018. As is known, almost all buildings in Palu City suffered minor or severe damage.

An initial review at the site of ongoing building construction work in Palu City found that the work has not had maximum Performance due to various risks. Therefore, the researcher wanted to examine several buildings in Palu City to identify risk factors affecting building performance in Palu City. The expected outcome of this research is to inspire positive change in local government and the construction industry by highlighting the most influential risks to implementing building works in Palu City and suggesting practical ways to handle them. This will provide crucial input to interested parties, motivating them to play their part in improving building construction performance.

II. LITERATURE REVIEW

A. Building Construction Project

According to [1], the project is complex, not routine, or always there, and has a time limit, cost, and shape according to design specifications to meet different consumer desires. [2] Also mentioned is that a construction project is an activity that is only done once and usually lasts a short period. It is done by managing the project resources owned. [3] explains that a construction project is a series of activities to achieve objectives following the design, considering specific time, cost, and quality constraints and activities carried out by managing resources (people, materials, machines, methods, and money). Meanwhile, [4] explained that projects are temporary activities, have time constraints, and are allocated resources as planned.

Building Law No. 28 of 2002 states that buildings are a tangible manifestation of construction integrated with their surroundings. People congregate in the building to engage in a variety of activities. The building is a place where people gather to carry out various activities. So, it can be concluded that a building construction project is a temporary activity in making a building, which is a physical form of construction work and is used.

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B. Performance

Project performance is the degree to which project objectives are achieved within a specified timeframe. In building construction, 'performance' refers to completing a project within specified time constraints, budget, and quality standards so that every building construction implementation activity will require good performance.

The same opinion from [5] [6] Performance describes the outcomes that a team of people in an organization may attain to meet its objectives within a given time frame.[7] Summarises the definition of performance provided by many management experts as the result of group work activities in an organization, influenced by internal and external elements, to achieve organizational goals within a given time frame.

C. Construction project risk

Construction project risks are obstacles that occur in the implementation of construction work. As stated by [1], every project will inevitably face various risks that need to be managed, some of which can be minimized, while others may be unexpected [1]. [24] states that the most critical project management task is to ensure that risks caused by various factors can be minimized or eliminated. Eight also mentioned that risk is an event or activity that tends to harm project activity planning and performance. The risk of project activities can be measured from the likelihood of incidents and potential severity [25].

As explained by [1], Risk in projects refers to the possibility of adverse monetary or physical outcomes due to choices made or environmental circumstances at the site of an activity. In the context of chance, "risk" refers to the possibility of an unforeseen circumstance with all the potential repercussions that could result in project delays or failures. Risk consists of two main elements for a single event: probability and impact. [9], [10], [11] Risks are unpredictable events that can affect project objectives related to budget, schedule, and quality if they occur. [12] Risk is the opportunity for undesirable results, especially events that, if they occur, can increase the likelihood of not achieving project objectives, including (1) the possibility of loss, (2) uncertainty, (3) the spread of actual results from expected results, (4) the possibility of results that are different from those expected. However, [3] and [12] state that the concept of risk in projects measures the probability and consequences of not achieving predetermined project goals.

D. Risk Factors

[13], [14] [15] explain the various risk factors that affect the performance of construction work implementation, the same opinion from the results of literature studies, previous studies, and various existing journals. So it is concluded in the research that these factors are (a) Material factors, (b) Equipment factors, (c) Financial factors, (d) Environmental and community factors, (e) Labor factors, (f) Planning factors, and (g) Management factors.

III. METHOD

A. Research Location

The research location was carried out at the building work in Palu City, Central Sulawesi province. Palu City, as the capital city, has a lowland with an average altitude of + 84 meters above sea level, located in the position of 2o22' North latitude and 3o48' South latitude, and 119o22' and 124o22' East longitude. At the same time, the area of Palu city is 395.06 km2, as seen in the figure 1.

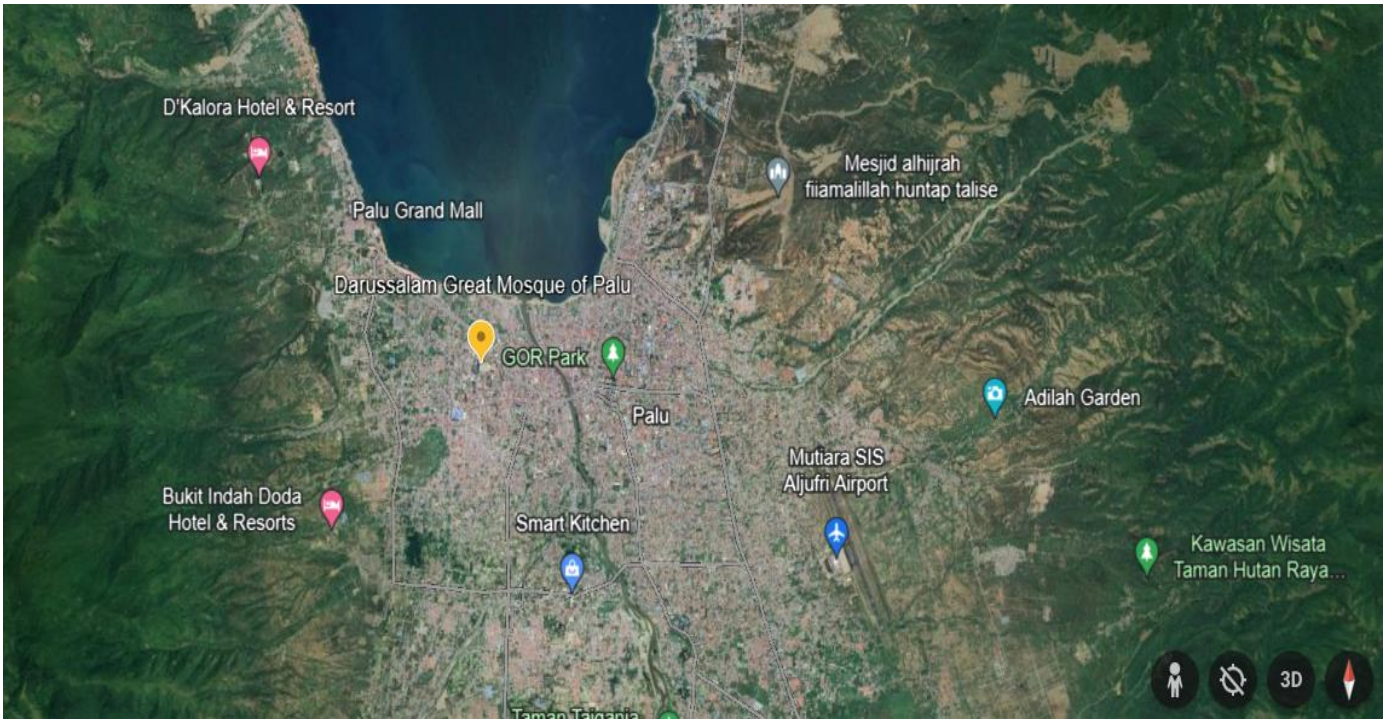

Fig1 Regional Plan of Palu City, Central Sulawesi Province

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B. Research Design

Technical data analysis involves investigating, cleaning, transforming, and modeling data helpful in informing conclusions and supporting decision-making. [17], [18], [19]. Analysis done to ascertain whether independent components exist is known as descriptive statistical analysis, either only on one or more factors (independent factors or independent factors), without making comparisons of the factors themselves and looking for relationships with variables. [20] [21] [22] [17] In descriptive analysis, the respondents' average for each variable is determined. Respondent's answers to variables or indicators are good if they have a higher average value.

The population is experts in construction projects, totaling 47 people; data can be seen in Table 1. The questionnaire was tested, namely the validation test and reliability test. The validation test is carried out to measure the authenticity of the factor with precise and accurate truth. The test is said to be valid based on what should be tested. The reliability test is carried out to determine whether the results of the measurements used are fixed, reliable, and free from measurement error. Reability shows how much control measurements have over the same subject [23].

Data analysis uses multiple linear regression techniques. A model that incorporates various independent factors is known as multiple linear regression. The relationship between the independent and dependent factors is ascertained through analysis. There are several tests in various linear regression calculations, namely the F, T, and R tests. The Statistical Product and Service Solutions (SPSS) software uses multiple linear regression model calculations as a calculation tool. The general form of the equation used is Y = a + b1X1 + b2X2 + b3X3 + b4X4 + e. Description: a = constant; b = regression coefficient; X1 = management factor; X2 = financial factor; X3 = material factor; X4 = labor factor; Y = dependent factor (building construction project performance); and e = error factor.

Table 1 Research Respondent

No	Description	Unit	People
1	Undata Hospital Building Phase II (supervisory consultant, contractor, surveyor, k3 implementer)	1	15
2	Tadulako University Teaching Hospital building (project head, project manager, field executor, supervisory consultant)	1	16
3	Construction of Darusallam Grand Mosque Building (Owner, contractor, and consultant)	1	16
	Total		47

IV. RESULTS AND DISCUSSION

A. Profil Respondent

The profiles of the respondents who completed the questionnaire are as follows. As many as 47 people were reviewed based on gender, length of work experience, and the most recent education can be seen in Table 2.

Table 2 The Respondent's Profile

No	Description				Amount	
		1	*2*	*3*		*%*
A	*Gender*					
	Male	12	13	9	34	72
	Famale	4	2	7	13	28
B	*Work Experience*					
	< 5 years	7	5	9	21	45
	6-10 years	1	4	2	7	15
	>10 years	8	6	5	19	40
C	*Education*					
	high school	0	1	1	2	4
	bachelor graduates	15	13	11	39	83
	graduate degree	1	1	4	6	13
D	*Certificate Ownership*					
	Has	13	11	15	39	83
	Do not Have	3	4	1	8	17

B. Validity Testing

Testing was conducted on a total of 25 questionnaires. The measurement uses a significant level of 0.05, so the R table value is 0.4973. The calculations used the Statistical Product and Service Solution (SPSS) computer program. If the value of r count> 0.4973 is obtained, the result is valid; otherwise, if r count ≤ 0.4973, the result is invalid.

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C. Reliability Testing

The reliability test was carried out on 25 question items, and the overall Cronbach's Alpha value was> 0.7, indicating that the answers given by respondents were good.

Table 3 The Results of The Reliability Test

Number of Question Items	the results of the Cronbach's Alpha test	Minimum Cronbach's Alpha Value	Description
25	0,956	0,7	*Reliable*

D. Simultaneous Test

The simultaneous test is carried out to determine how much influence the independent factor has on the dependent factor.

Table 4 F Test Of Risk Probability

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.063	4	6.266	23,918	0,000[b]
	Residual	5.490	42	3.464		
	Total	2.553	46			
a. dependent variable: building work performance						
b. Predictors: (Constant): management, finance, material, workers						

The calculation result obtained the simultaneous value (F) count of 23.918, and the sig value is 0.000. Results can be seen in Table 4, while the F table value is 2.410 and the α is set at 0.05. Because the F value is 23.918>2.410 and the sig value is. 0.000 T table and sig value. <0.05, it can be concluded that there is an influence of factor X on factor Y.

Table 5 F-Test of Risk Impact

Model	Sum of Squreas	df	Mean Square	F	Sig
Regression	4.648	4	3.162	25,675	0,000[b]
Residual	7.054	42	1.168		
amount	1.702	46			

The calculation result obtained the simultaneous value (F) count of 25.675, and the sig value is 0.000. Results can be seen in Table 5, while the F table value is 2.410 and the α is set at 0.05. Because the F value is 25.675>2.410 and the sig value is. 0.000 T table and sig value. <0.05, it can be concluded that there is an influence of factor X on factor Y.

E. T Test

The test is one of the statistical tests used to individually test the effect of one independent factor (X) or explanatory in explaining the dependent factor (Y). The calculation uses the SPSS statistical program, and Table 6 displays the results.

Table 6 T-Test of The Risk Probability Question

Coefficients					
Model	Un-standard Coefficients		Standardizd Coeffic.	t	Sig.
	B	Std.Err	Beta		
(Constant)	0.850	4,790		0.455	0.848
Management (X1)	0.873	0.450	0.970	9,405	0.000
Finance (X2)	0.765	0.556	0.653	5,730	0.002
Material (X3)	0.932	0.347	0.940	8,234	0.000
Wokers (X4)	0.822	0.215	0.765	7,350	0.000

a. Dependent Variable: Building Work Performance (Y)

After the T-test was carried out, the sig value was obtained. 0.000 < 0.005. The T value of each factor is obtained for the Management factor T count 9.405> 1.679, the Finance factor T count 5.730> 1.679, the Material factor T count 8.234> 1.679, and the Labor factor T count 7.350> 1.679. The multiple linear regression equation Y = 0.850 + 0.873 (X1) + 0.765 (X2) + 0.932 (X3) + 0.822 (X4). The results of the above equation show the influence between independent and dependent factors.

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Table 7 T-Test of Risk Impact Questions

Coefficients					
Model	***Unstandardized Coefficients***		***Standardized Coeffic.***	***t***	***Sig.***
	B	***Std.Err***	***Beta***		
(Constant)	0.604	3,754		0.560	0 .918
Management (X1)	0.993	0.371	0.993	8,191	0.000
Finance (X2)	0.782	0.056	0.660	4,765	0.002
Materials (X3)	0.974	0.245	0.953	9,234	0.000
Wokers (X4)	0.830	0.115	0.721	6,108	0.000

a. Dependent Variable: Building Work Performance (Y)

b.

After the T-test was carried out, the sig value was obtained. 0.000 < 0.005. The T value of each factor is obtained for the Management factor T count 8.191> 1.679, the Finance factor T count 4.765> 1.679, the Material factor T count 9.234> 1.679, and the Labor factor T count 6.108> 1.679. The multiple linear regression equation Y = 0.604 + 0.993 (X1) + 0.782 (X2) + 0.974 (X3) + 0.830 (X4). The results of the above equation show the influence between independent and dependent factors.

F. Determinant Coefficient Test (R2)

The determinant coefficient test determines how much percent of the influence is given by factor X simultaneously (together) with factor Y.

Table 8 R^2 Calculation of Risk Probability

Model Summary				
Model	***R***	***R Square***	***Adjusted R Square***	***Std. Error of the Estimate***
1	0.965[a]	0.865	0.770	31.98275
a. Predictors: (Constant), Management, Finance, material, workers				

Table 9 R^2 Calculation Of Risk Impact Questions

Model Summary				
Model	**R**	***R Square***	***Adjusted R Square***	***Std. Error of the Estimate***
1	0.930[a]	0.897	0.840	31.40983
a. Predictors: (Constant), Management, Finance, material, workers				

The adjusted r-squared coefficient of determination is displayed in Tables 8 and 9, results from the risk probability and risk impact of 0.770 and 0.84 or 77% and 84%, which means that the independent factors in this study (management, finance, materials, and labor) influence 77% and 84% of the dependent factor (building, work implementation performance (y)).The remaining 23% and 16% are external factors that are not included in this study. The regression model is good if more than 50% because independent factors can explain the dependent factor.

G. Analysis of the results of the relationship between dependent factors and independent factors

- *The influence of Factor X1 (Management) on Factor Y (Performance of Building Work Implementation) on questions of Probability and impact of risk*
- Based on the testing results, the influence of management factors has a positive effect on the performance of the implementation of building work, with significant values of 0.873 and 0.993. The conclusions of the multiple linear regression analysis show that management factors significantly and favorably affect the extent to which construction projects are implemented.
- *The influence of Factor X2 (Finance) on Factor Y (Performance of Building Work Implementation) on questions of Probability and impact of risk.*
- Based on the testing results, financial factors significantly affect how building projects are implemented and have significant values of 0.765 and 0.782. The results of multiple linear regression analysis show that economic factors substantially and favorably impact the performance of Building work implementation
- *The influence of Factor X3 (Materials) on FactorY (Performance of Building Work Implementation) on questions of probability and risk impact*
- Based on the results of testing the influence of material factors on the performance of building work implementation with a significant value of 0.932 and 0.974, the results of multiple linear regression analysis calculations show that financial factors have a positive and considerable influence on the implementation of building projects.
- *The influence of Factor X4 (Labor) on Factor Y (Performance of Building Work Implementation) on Probability and Impact of Risk.*
- The results obtained a significant coefficient of 0.822 and 0.830, indicating that labor factors positively and significantly impact the performance of construction work implementation.

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H. Preventive Measures on the Factors that Most Affect the Performance of Building Work Implementation

The results showed that management and material factors had the most decisive influence on the performance of building works implementation in Palu City, therefore several preventive measures were taken to reduce risks. The explanation is in Table 10.

Table 10 Response to Risk Occurrence

No	Variable of Risk	Risk Response	Description
		Management	
1	Project design changes, data errors, or incomplete data	Risk Reduction	Organizing a meeting between the parties involved in the project implementation, Making claims for additional resources, project implementation time, and costs.
2	The contractor plans the schedule (cost, material, labor, and equipment) not by the condition of	Risk Reduction	Improving the project implementation schedule and Creating alternatives for suppliers who can fulfill the order.
3	Implementation of fieldwork supervision system	Risk Reduction	Improving the field supervision system; ensuring supervisors perform their duties using the guidelines or standard operating procedures (SOP).
		Materials	
1	Implementation of fieldwork supervision system	Risk Reduction	Collecting information on the availability of materials around the project site; Make early orders for materials that are difficult to obtain
2	Material damage used	Risk Reduction	Planning the placement of materials, adjusting to the type and quantity of materials
3	Quantity of materials that do not match the order	Risk Reduction	Planning a schedule of material requirements based on the schedule and type of work to be carried out. so that materials can be made available before work begins.

V. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

This study concludes that there is a significant influence between the independent factors of Management (X1), Finance (X2), Material (X3), and Labor (X4) on the performance of construction work implementation. The relationship between independent and dependent factors is obtained by the equation of risk probability Y1 = 0.850 + 0.873 (X1) + 0.765 (X2) + 0.932 (X3) + 0.822 (X4) and risk impact Y2 = 0.604 + 0.993 (X1) + 0.782 (Xu2) + 0.974 (X3) + 0.830 (X4). The calculation results of the coefficient of determination test (R test) obtained the Adjusted R Square value, meaning that the simultaneous influence on the performance of construction work implementation is 77% and 84%.

B. Suggestions

- Provide input to the building project manager to make the primary considerations related to the most influential risk factors in implementing development activities.
- This is a reference and input for future researchers related to risk factors that must be considered and subsequent research on other risk factors that have never been researched.

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