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ANALYSIS OF FACTORS THAT AFFECT THE RISK OF IMPLEMENTATION OF UNDERPASS PROJECT CONSTRUCTION IN MAYJEN SUNKONO SURABAYA

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ABSTRACT

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Construction project risk management is one part of the knowledge area recommended by PMBOK international standards and ISO 21500. The application of risk management is very important and becomes an indispensable requirement in every construction work. This study aims to analyze the factors that influence the risk of implementing an underpass project located at the satellite roundabout Mayjen Sungkono Surabaya-Indonesia. The research method was conducted by surveying 35 respondents who were directly or indirectly involved in the implementation of the project. The data collection tool is a Likert scale questionnaire (1-5). Data analysis using the help of SPSS and Smart PLS software. The results of the study concluded that seven aspects, namely: natural, economic and financial, planning, construction, risk management, project management and the project environment had a positive and significant effect on the occurrence of project risks in terms of time, quality, costs and workplace accidents.

Keywords: risk-management, project, underpass, design, construction, lingkungan

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1. INTRODUCTION

The risks involved in construction projects are very large, but not all of these risks need to be predicted and considered in starting a project because it will take a long time [1]. Therefore, the parties involved in the construction project need to prioritize important and relevant risks that will have an impact on project losses [2].

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Several previous studies related to the application of risk management projects have been carried out, including in the fields of construction project management, [3] [4] [5] [6] and [7]. In the field of housing development [8] [9] [10] [11] [12] [13] and [14]. Research in the fields

of multi-storey buildings [15] and [16]. Fields of toll roads and bridges [17] [18] [19] [20] [21] [22] [23] [24]. Fields of railways, ports and docks and other civil fields [25] [26] [27] [28] and [29].

Like other construction projects, underpass construction projects are complex projects that do not escape the various risks that might occur. Handling bad risks on the project can cause significant losses, work becomes late or decreases the quality of work. Research on risks that occur in the field of construction of underpass projects so far is still rare in Indonesia. Based on the description above, this study was conducted to implement risk management in the construction of an underpass located in the satellite roundabout of Mayjen Sungkono Surabaya.

2. METHOD AND MATERIAL

2.1. Project Description

The underpass project at the Mayjen Sungkono satellite roundabout Surabaya-Indonesia City was built from 2016-2019. At the time this research was carried out, project work was under construction. This project is located at the intersection between 4 lanes, namely Mayjend Sungkono road, H.R Muhamad road, satellite toll gate access and Kupang Indah City Surabaya road. Project funds were obtained from the CSR collection of developer companies with offices around Mayjen Sungkono Surabaya. The purpose of the construction of this project is to anticipate traffic congestion which is increasingly predicted to increase. Map of the project location in detail can be seen through the google map as shown in Figure 1 below.

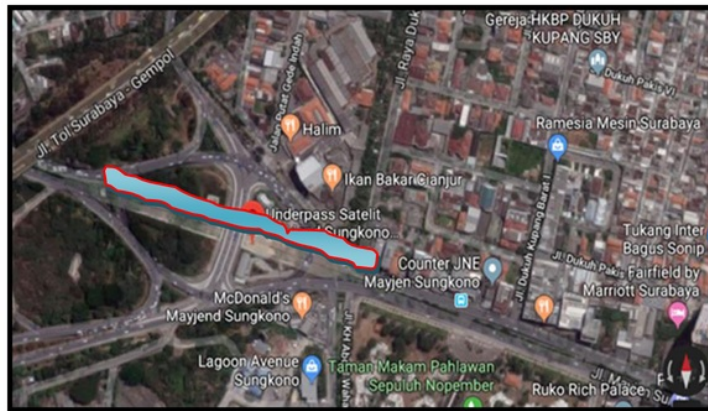


Figure 1 Location Map of Underpass Mayjen Sungkono Surabaya

2.2. Data and Research Instrument

The research data was collected through surveys and interviews using a Likert scale questionnaire (1-5). Respondents who were the object of this research sample were construction practitioners who knew or worked directly or indirectly in the process of implementing the project. The number of respondents used as data input were 35 respondents consisting of: Project Manager, Site Manager, Quality Control (QC), QC Staff, and Project Implementers as well as staff of the Head of the Public Works, Highways and Drainage Office of the Surabaya City Government directly involved or indirectly in the implementation of the project.

2.3. Modeling and Research Hypotheses

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This research is modeled as descriptive research by assuming the relationship between the independent variable and the dependent variable. The independent variable consists of seven variables which consist of aspects: natural, economic & financial, planning, implementation, risk management, project management and the environment. While the dependent variable consists of one variable, namely project risk. The relationship between independent and bound variables is based on previous research (Santoso, 2017; Dewi & Cahyono, 2013; Zainuddin, 2014; Purwanggono & Margarette, 2017; Harahap et al., 2010) [30] [31] [32] [33] [34]. Each variable and indicator can be seen in Table 1 below.

Tabel 1 Research Variables and indicators

No	Variable	Code	Indicator
1	Natural Aspects [30][31][32][33][34]	X.11	Fire
		X.12	Earthquake
		X.13	Flood
		X.14	Changes in the weather
2	Economic & Financial Aspects [31][32][33][34][35][36]	X.21	Interest rate fluctuations.
		X.22	Inflation
		X.23	Material price increase
		X.24	Government monetary policy
		X.25	Contractor Cash Flow is not good
		X.26	Increase in labor costs
3	Planning Aspect [33][34][37][38][39]	X.31	Delay in the pPlanning process
		X.32	Planning Error
		X.33	Change in Planning
4	Project Construction Aspects [30][31][32][35][36][37][38][39]	X.41	Material theft
		X.42	Material use error
		X.43	Less quality material
		X.44	Job fields that are not ready
		X.45	Unstable land conditions
		X.46	Utilities on the project
		X.47	The method of implementation is not quite right
		X.48	Material / equipment not available
		X.49	Condition of the existing project
		X.410	Equipment maintenance is not right
		X.411	Repeat work
		X.412	Job quality is not achieved
5	Risk Management Aspect [33][34][1][29][40]	X.51	Low labor productivity
		X.52	Low equipment productivity
		X.53	Lack of understanding of K3 aspects in the field
		X.54	Work accident
		X.55	Labor dispute
		X.56	Lack of communication between staff

No	Variable	Code	Indicator
6	Project Management Aspects [33][34][1][29][40]	X.61 X.62 X.63	Error bidding procedure Project delay Project management team
7	Environmental Aspects [30][31][32][33][34]	X.71 X.72 X.73 X.74	Air pollution and noise The presence of material remains scattered on the highway Road damage around the project Traffic jams around the project

Based on the theoretical and empirical studies above, research model is illustrated as shown in Figure 1 below. Kemdian Research hypotheses is described as follows:

1. H1 = The risk of Nature has a positive and significant effect on the risk of an underpass project at the satellite roundabout in Mayjend Sungkono-Surabaya.
2. H2 = The risks of Economic and financial have a positive and significant effect on the risk of an underpass project at the satellite roundabout in Mayjend Sungkono-Surabaya.
3. H3 = The risk of project design has a positive and significant effect on the risk of underpass projects on the satellite Mayjend Sungkono Surabaya.
4. H4 = The risk of risk management has a positive and significant effect on the risk of an underpass project at the Mayjen Sungkono Surabaya roundabout
5. H5 = The risk of project design has a positive and significant effect on the risk of underpass projects on the satellite Mayjend Sungkono Surabaya
6. H6 = The risk of construction management has a positive and significant effect on the risk of an underpass project at the Mayjen Sungkono Surabaya roundabout.
7. H7 = Environmental risk has a positive and significant effect on the risk of underpass projects at the Mayjen Sungkono Surabaya roundabout.

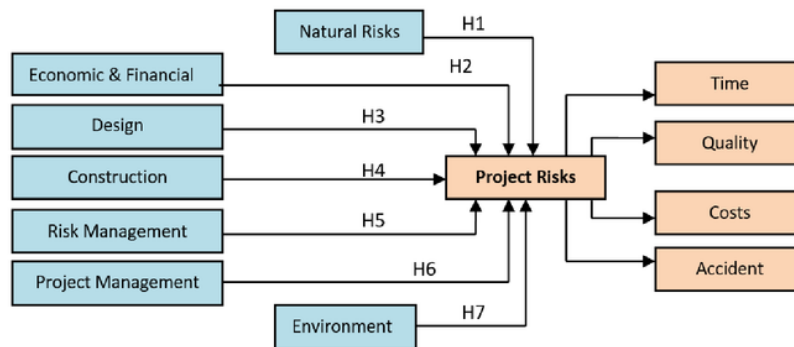


Figure 2 Research Model Based on Project Site & Previous Researchers

2.3. Definitions of Variables and Indicators

- The risk of aspects of nature are all-natural risks that occur because of destiny or God's will [30][31][32][33][34].
- Risk of economic & financial aspects, namely the occurrence of micro or macro economic changes, regionally, nationally and internationally that can affect directly or indirectly the funding of projects that are being implemented [31][32][33][34][35][36].

- The risk of planning aspects is the fault of the consultant planner in terms of planning architecture, structure, environmental, mechanical and electrical systems. This risk is also related to the preparation of contract documents that contain work drawings, technical specifications, administrative requirements and budget plans [33][34][37][38][39]
- Risk aspects of project implementation are errors that occur during the project implementation process, both constructive and non-constructive, technical and non-technical, administrative and non-administrative [30][31][32] [35][36][37] [38][39] .
- Risk of risk management aspects are all risks caused by the risk management system that is implemented in the project during the implementation of the project. Project risk management generally consists of human resource management (work productivity), equipment management, occupational health and safety management, quality management, project management and project financial management [33][34][1][29][40]
- Project management risk is all the risks that occur due to the implementation of project management that is less competent starting from the planning process, tender process, implementation process, up to the maintenance and operational process [33][34] [1][29][40].
- Risks of Environmental aspects are all risks caused by adverse impacts resulting from human or natural actions around the project site [30][31][32][33][34] .

3. DATA ANALYSIS

3.1. Test Validity and Reliability Instrument

Preliminary research (10 sample respondents) was conducted to test the research instrument with validity and reliability test. Berdasarkan sajian data dalam Tabel 2 di bawah dapat diketahui bahwa nilai *composite reliability* semua variabel penelitian $> 0,7$. Hasil ini menunjukkan bahwa masing-masing variabel telah memenuhi *composite reliability* sehingga dapat disimpulkan bahwa kesesuaian variabel memiliki level *internal consistency reliability* yang tinggi. Sedangkan hasil *Average Variance Extracted* (AVE) setiap variabel laten $\geq 0,5$ artinya tiap variabel memiliki parameter *convergent validity* yang layak digunakan. Result of validity and reliability test are shown in Table 2. Instrument of research was appropriate to be used for further research [1][42].

Table 2 Summary of Test Results on Validity & Reliability

Var. 13	Composite Reliability	Remarks	Cronbach's Alpha	Remarks
(X1)	0,82079	Composite Reliability $> 0,50$ Reliable (OK)	0,79620	Cronbach's Alpha $> 0,70$ Valid (OK)
(X2)	0,94470		0,90525	
(X3)	0,84135		0,82960	
(X4)	0,96063		0,94590	
(X5)	0,94291		0,92999	
(X6)	0,92173		0,88813	
(X7)	0,88763		0,88760	
(Y)	0,74470		0,83656	

Source: Results of PLS analysis

3.2. Factor Analysis

Factor analysis was done with Smart PLS software. Result of factor analysis showed the relationship of each variable and value (coefficient) factor loading of each indicator.

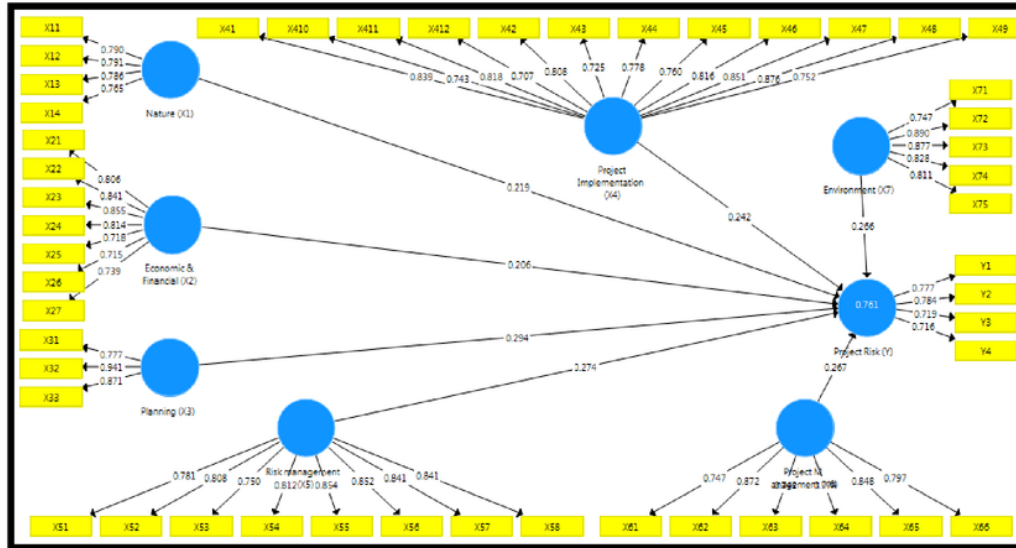


Figure 3 Smart PLS Factor Analysis Results

Factor loading was a coefficient generated from the evaluation of confirmatory factor analysis for the measurement model. Factor loading was used to assess the suitability, conformity or uni-dimensional of dimensions in forming a factor. Loading Factor estimation value was derived together with Loading Factor estimation results for each of variables factors against the indicators as shown in Figure 3.

3.3. Hypotheses Testing

Hypotheses testing was done by t-test on each path of direct influence partially between latent variables. The indirect influence between latent variables was evidenced by the proof of each path of direct influence, i.e. if the whole path of direct influence was significant, then direct influence was also significant. If there was at least one indirect influence was non-significant, then indirect effect was non-significant. Summary of hypotheses testing results is shown in Figure 4. Hypothesis testing was done by comparing values of t-test of each latent variable with t-table (1.96). The value was significant if t-test latent variable was bigger than t-table (t-test > 1.96). Hypotheses test results of each latent variable are shown in Table 4.

1 Analysis of Factors that affect the Risk of Implementation of Underpass Project Construction in Mayjen Sungkono Surabaya

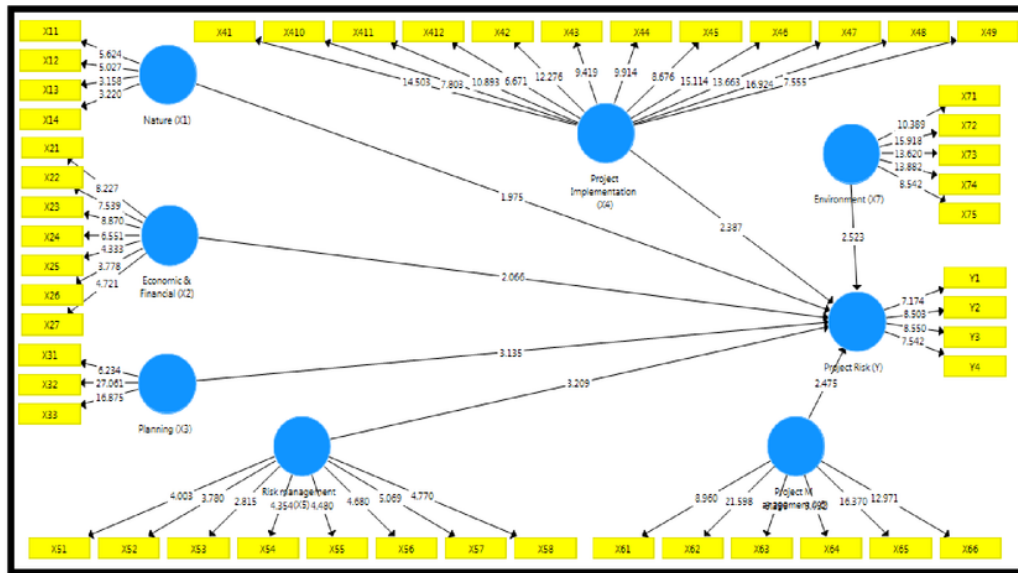


Figure 4 Smart PLS Hypothesis Test Results

Table 4 Influence Between Latent Variables

Latent Variables (relation)		Path Coefficient	t-test	Criteria t-test > t-table = 1,96
(X1)	(Y)	0,219	1,975	Significant
(X2)	(Y)	0,206	2,066	Significant
(X3)	(Y)	0,294	3,135	Significant
(X4)	(Y)	0,242	3,209	Significant
(X5)	(Y)	0,274	2,387	Significant
(X6)	(Y)	0,267	2,475	Significant
(X7)	(Y)	0,266	2,523	Significant

Source: Results of PLS analysis

3.4. Influence Analysis of Latent Variables

After each influen⁵ of the latent variables is analyzed with the help of Smart PLS software and it is known to have a positive and significant influence on the occurrence of project risk (see Figure 3 and Figure 4 above), then calculated to what extent the latent variables influence project risk (see Table 5 below).

Table 5 Coefficient of Determination (R^2)

Latent Variable	(R^2)	(R^2)Adjusted
Project management knowledge (X2)	0,76131	0,72153

Source: Results of PLS analysis

Based on the data presented in Table 5 above, it can be seen that the R-Square value for Project Risk is 0.76131 (76.13%). These results explain that the percentage of project risk can be explained by the independent variable of 76.13 percent. While other variables not used in this study can explain the effect of 33.87%

4. RESULT AND DISCUSSION

- **The Effects of natural aspects on project risk :** The risk of aspects of nature are all natural risks that occur due to destiny or God's will. Based on several references [30] [31] [32] [33] [34], natural aspects consist of: fires, earthquakes, floods and weather changes. The results of the study show that these natural aspects have a positive and significant effect on project risk.
- **The Effect of economic and financial aspects on project risk :** These economic & financial aspects occur because of regional or national or international economic or micro-economic changes that can directly or indirectly affect the funding of projects being implemented [31] [32] [33] [34] [35] [36]. Based on some of these references, the economic and financial aspects consist of: interest rate fluctuations, inflation, increases in material prices, government monetary policy, contractor's financial cash flow and increases in workers' wage prices. The results showed that economic and financial aspects had a positive and significant effect on project risk.
- **The effect of project design on project risk :** The risk of project design aspects caused by the consultant planner's mistakes in terms of planning architecture, structure, environmental, mechanical and electrical systems. This risk is also related to the preparation of contract documents that contain work drawings, technical specifications, administrative requirements and budget plans [33] [34] [37] [38] [39]. Based on these references, the risk aspects of project planning consist of: planning delays, planning errors and planning changes. The results of the study indicate that the aspects of project planning have a positive and significant effect on project risk.
- **The Effect of project construction on project risk :** Risk of project construction aspects that occur during the project implementation process, both constructive and non-constructive, technical and non-technical, administrative and non-administrative in nature [30] [31] [32] [35] [36] [37] [38] [39]. Based on these references, the planning aspects of the project consisted of: theft of building materials, misuse of material, poor quality materials, unprotected land ready for work, unstable soil conditions, improper utility at the project site, late arrival of materials and equipment or not available, existing project conditions, poor maintenance of equipment and the occurrence of repeated work. The results of the study indicate that aspects of project implementation have a positive and significant effect on project risk.
- **The Effect of risk management on project risk:** Risks due to aspects of risk management can be caused by the risk management system implemented in the project during the implementation of the project. Project risk management generally consists of human resource management (work productivity), equipment management, occupational health and safety management, quality management, project management and project financial management [33] [34] [1] [29] [40]. Based on these references, the risk aspects due to risk management consist of: low labor productivity, low work productivity, lack of understanding of occupational health and safety aspects in the field, workplace accidents, lack of communication between workers and worker disputes or disputes. The results of the study show that the risk management aspect has a positive and significant effect on project risk.

- **The Effect of project management on project risk:** Project Management Risks that occur due to the implementation of less professional project management starting from the planning process, tender process, implementation process, handover up to the maintenance and operational process [33][34] [1][29][40]. Based on of these references, the risk aspects due to aspects of project management consist of aspects: errors in tender procedures, delays in project implementation schedules and inability of project management. The results of the study indicate that aspects of project management have a positive and significant effect on project risk
- **The effect of the project environment on project risk:** The risk of project environmental aspects caused by adverse impacts resulting from human or natural actions. Based on these references, the risk aspects due to the project environment consist of aspects: air pollution and noise, residual material scattered on the road, road damage around the project and traffic density [30] [31] [32] [33][34] The results of the study show that the environmental aspects of the project have a positive and significant effect on project risk.

5. CONCLUSIONS

The results of this study conclude that seven internal and external aspects of the project which consist of aspects: natural, economic and financial, planning, implementation, risk management, project management and project environment have a positive and significant effect on the occurrence of project risk consisting of time risk, quality risk, risk of costs and risks of workplace accidents. It is recommended for further research to analyze risk level and risk mitigation.

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