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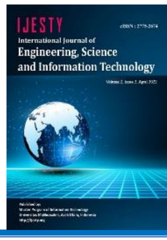

Identification of Factors Caused The Risk of Time Delays in The Pulogadung

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Abstract

To provide livable housing for the residents of DKI Jakarta, especially in urban areas with minimal land availability, the DKI Jakarta Provincial Government supports the development of vertical housing to offset the high demand for housing and limited land. Through the Department of Public Housing and Settlement Areas, the Provincial Government of DKI Jakarta is implementing the Pulogadung-East Jakarta PIK Flats Construction Project. When this research was carried out, the Pulogadung-East Jakarta PIK Flats Construction Project was entering week 63, with work progress reaching 47.689% of the planned 48.725%, or in other words, this project experienced a delay of 1.036% of the scheduled. Therefore, it is necessary to conduct research that aims to identify the factors that cause the risk of time delays, analyze the most dominant factors that lead to the risk of time delays, and look for the necessary handling actions so that the risk of time delays that occur does not increase or can also be prevented or resolved. In this study, the descriptive quantitative method is carried out by surveys, interviews, and distributing questionnaires to respondents. The risk rating was analyzed using MS. Excel is based on a probability and impact matrix, which aims to determine variables with a high level of risk, then expert validation is carried out regarding risk management. And from the analysis results obtained, six variables that cause the risk of time delays in the Pulogadung-East Jakarta PIK Flats Development Project work can occur, namely Late Payment of Term by Owner, Design Changes, Lack of Coordination While Working, Inaccuracy of Material Order, Time, Limited Material Availability in the Market, and the Occurrence of the Corona Outbreak (Covid 19). The results of expert recommendations for the six variables can be expressed in handling actions.

Keywords: *Risk Management, Time Delay, Construction Management.*

1. Introduction

To provide livable houses for residents of DKI Jakarta, especially in urban areas with minimal land availability, the DKI Jakarta Provincial Government supports the development of vertical housing to offset the high demand for limited housing land. Through the Department of Public Housing and Settlement Areas, the Provincial Government of DKI Jakarta is implementing the Pulogadung-East Jakarta PIK Flats Construction Project. The project work is a manifestation of the efforts of the DKI Jakarta Provincial Government in providing public housing for the people of DKI Jakarta [1] [2].
When this research was carried out, the PIK Pulogadung-East Jakarta Flats Development Project was in its 63rd week, with work progress reaching 47.689% of the planned 48.725%, or in other words, this project experienced a delay of 1.036% of the project scheduled [3] [4]. With the planned implementation time of the project work, which is until October 2021, as well as the high complexity of the job if you look at the data on land area and the height of construction that is still to be built, the work of the East Jakarta PIK Pulogadung Flats Development Project cannot be separated from the risk of delays [5] [4]. Time and it is possible that the time delay that occurs at this time can be even more significant. Therefore, it is necessary to conduct research that aims to identify the factors that cause the risk of time delays, analyze the most dominant factors that lead to the risk of time delays, and look for the necessary handling actions so that the risk of time delays that occur does not increase or can also be prevented resolved [6] [7].

2. Method

In this study, the descriptive quantitative method is carried out by surveys, interviews, and distributing questionnaires to respondents [8]. The risk rating was analyzed using MS. Excel-based on the probability and impact matrix table, which aims to determine the variables with a high level of risk, then expert validation is carried out on risk management against the dominant threat [9] [10]. The following is a flow chart in this study [11] [9]:

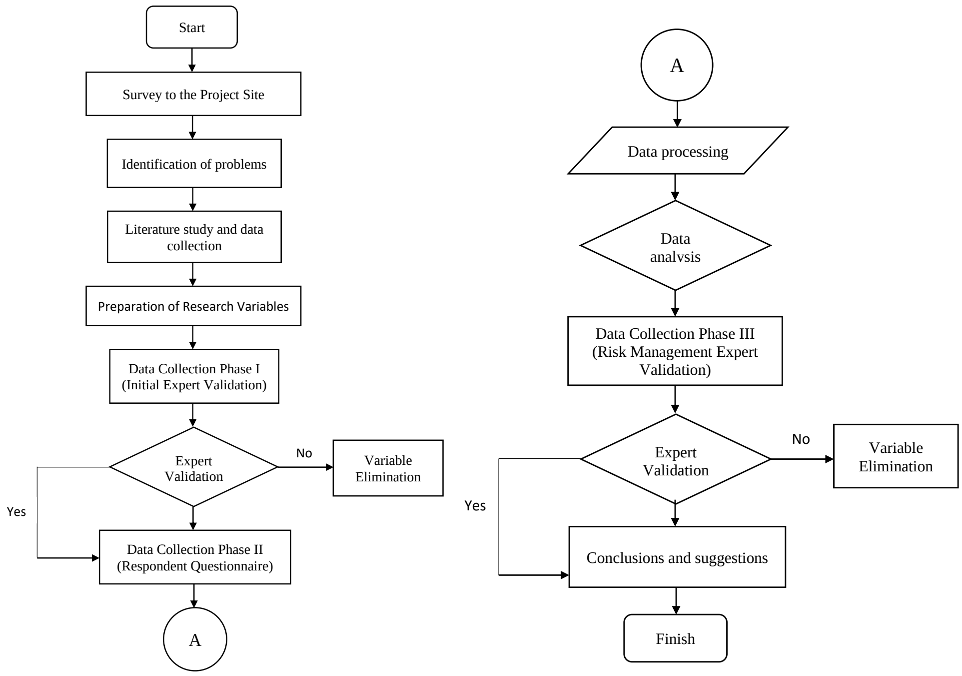

Fig 1. Research Flowchart

3. Results and Discussion

3.1 First Stage Data Collection

The first data collection stage is done by distributing questionnaires to experts, also called initial expert validation [9]. The first stage of data collection or initial expert validation aims to seek opinions from experts regarding the independent variables that have previously been compiled from the literature study, whether they are relevant to the risk of time delays [12] [13]. The following are the results of the first stage of data collection:

Table 1. The Results of the First Stage of Data Collection

Variabel		Expert Results					Explanation
		PL1	PL2	PL3	PL4	PL5	
Labor Factor							
X1	Insufficient Skill	Yes	Yes	Yes	No	Yes	Take effect
X2	Lack of Skilled Manpower	Yes	Yes	Yes	Yes	Yes	Take effect
X3	Lack of Work Experience	Yes	Yes	Yes	No	Yes	Take effect
X4	Low Work Productivity	Yes	Yes	Yes	Yes	No	Take effect
X5	Lack of Coordination at Work	Yes	Yes	Yes	Yes	Yes	Take effect
X6	Workers Ignore Work Safety and Security	Yes	No	Yes	Yes	Yes	Take effect
Job Document Factor							
X7	Design Change	Yes	Yes	No	No	Yes	Take effect
X8	Changing Work Schedule	Yes	Yes	Yes	Yes	Yes	Take effect
X9	Low Document Control	Yes	Yes	No	No	Yes	Take effect
X10	Late Submission of Design Changes	Yes	Yes	Yes	Yes	Yes	Take effect
X11	Process of Requesting and Approval of Design Changes by Owner	Yes	Yes	Yes	Yes	Yes	Take effect
X12	There is a request for changes to the work that has been completed	Yes	No	Yes	Yes	Yes	Take effect
Material Factor							
X13	Delay in Material Delivery	Yes	Yes	Yes	Yes	Yes	Take effect
X14	Material Loss	Yes	No	Yes	No	Yes	Take effect
X15	Material Order Timeliness	Yes	Yes	Yes	Yes	Yes	Take effect
X16	Lack of Construction Materials	Yes	Yes	Yes	Yes	Yes	Take effect
X17	Poor Material Quality	Yes	Yes	Yes	Yes	Yes	Take effect
X18	Limited Availability of Materials in the Market	Yes	Yes	Yes	Yes	Yes	Take effect

Variabel		Expert Results					Explanation
		PL1	PL2	PL3	PL4	PL5	
Tool Factor (Machine)							
X19	Delay in delivery of tools to the project site	Yes	Yes	Yes	Yes	Yes	Take effect
X20	Low equipment productivity	Yes	Yes	Yes	Yes	Yes	Take effect
X21	Difficult access for heavy equipment to be used in project implementation	Yes	Yes	Yes	No	Yes	Take effect
X22	Lack of required number/capacity of heavy equipment	Yes	Yes	Yes	Yes	Yes	Take effect
X23	Heavy equipment damage	Yes	Yes	No	No	Yes	Take effect
X24	Inefficient use of equipment	Yes	Yes	No	Yes	Yes	Take effect
Cost Factor (Money)							
X25	There is a delay in payment to subcontractors through the main contractor	Yes	Yes	No	No	Yes	Take effect
X26	Funding problems from head office (Contractor)	Yes	Yes	Yes	Yes	Yes	Take effect
X27	Inflation affecting material prices	Yes	No	No	No	Yes	No effect
X28	Late payment term by owner	Yes	Yes	Yes	Yes	Yes	Take effect
X29	Additional costs for mobilizing & demobilizing new tools due to wrong work methods	Yes	Yes	Yes	Yes	Yes	Take effect
Other Factors							
X30	Lack of communication and coordination between the parties involved in the project	Yes	Yes	No	Yes	Yes	Take effect
X31	Lack of supervision over subcontractors and suppliers	Yes	Yes	Yes	Yes	Yes	Take effect
X32	There are public complaints due to construction implementation	Yes	No	Yes	No	Yes	Take effect
X33	Delay caused by weather	Yes	Yes	No	Yes	No	Take effect
X34	The occurrence of unexpected things (Natural Disasters, Fires, etc.)	Yes	Yes	Yes	Yes	Yes	Take effect
X35	The outbreak of the corona virus (Covid 19)	Yes	Yes	Yes	Yes	Yes	Take effect

From the results of the questionnaire recapitulation phase I (Initial Expert Validation), there is one variable that, according to the expert, does not affect the risk of time delays in the Pulogadung-East Jakarta PIK Flats Construction Project. Variables that the experts did not approve were omitted and not included in the second data collection phase [8].

3.2 Standard Value and The Ratio Value

The second stage of data collection is carried out after adjusting to the first stage of data collection (initial expert validation). The second stage of the questionnaire (Respondent Questionnaire) aims to obtain data which will later be processed and analyzed to get the factors that cause the risk of time delays and the most dominant factor that causes the risk of time delays in the work of the Pulogadung-East Jakarta PIK Flats Construction Project.

The second phase of data collection (Respondent Questionnaire) was carried out by distributing questionnaires to 30 respondents directly related to the Pulogadung-East Jakarta PIK Flas Construction Project. Where the tube one one0 resoneaavaavavailaavailableleleablents is taken from hg formula, which s as follows:

$$n = \left(\frac{N}{1 + N(e^2)}\right)$$

Where:

n = Sample Size

N = Population size in the Pulogadung-East Jakarta PIK flat construction project

e = Percentage of inaccuracy or sample error rate (using 5% or 0.05)

$$n = \left(\frac{32}{1+32(0{,}05^2)}\right) = 29{,}63 = 30 \text{ People}$$

From the above calculation, it can be obtained that the number of samples taken is 30 people. And here are the results of the second stage of data collection (respondent questionnaire), namely:

Table 2. Results of the Second Stage of Data Collection

Variabel	How Often It Occurs					How big is the impact				
	1	2	3	4	5	1	2	3	4	5
Labor Factor										
X1	5	4	11	8	2	4	1	8	12	5
X2	2	6	12	6	4	3	2	7	13	5
X3	3	6	13	6	2	1	4	11	11	3
X4	2	2	14	7	5	-	1	13	8	8
X5	1	3	11	11	4	-	1	8	15	6
X6	2	3	10	9	6	1	4	6	12	7

Variabel	How Often It Occurs					How big is the impact				
	1	2	3	4	5	1	2	3	4	5
Job Document Factor										
X7	1	1	11	11	6	-	2	10	12	6
X8	-	3	10	15	2	-	2	10	14	4
X9	1	6	14	8	1	-	5	13	10	2
X10	1	2	14	10	3	-	1	11	13	5
X11	-	2	13	14	1	-	4	8	15	3
X12	2	9	11	6	2	2	7	8	10	3
Material Factor										
X13	-	6	12	5	7	-	-	10	11	9
X14	5	7	6	9	3	1	6	7	10	6
X15	1	8	11	10	-	-	3	8	15	4
X16	1	7	8	11	3	-	1	6	18	5
X17	2	8	10	7	3	1	2	7	15	5
X18	4	9	8	7	2	2	2	10	14	2
Tool Factor (Machine)										
X19	1	9	12	6	2	-	4	8	12	6
X20	2	6	13	8	1	1	2	12	11	4
X21	4	9	11	3	3	2	2	11	11	4
X22	3	5	14	6	2	1	4	7	13	5
X23	-	13	9	5	3	-	3	6	12	9
X24	4	8	13	5	-	2	3	12	10	3
Cost Factor (Money)										
X25	-	3	17	7	3	-	2	12	11	5
X26	-	5	16	6	3	-	1	10	12	7
X28	-	3	13	8	6	1	2	8	9	10
X29	4	13	12	-	1	4	4	9	8	5
Other Factors										
X30	-	7	14	7	2	-	3	10	12	5
X31	2	4	17	6	1	1	2	15	8	4
X32	4	10	14	2	-	4	8	11	6	1
X33	1	8	13	6	2	3	2	13	10	2
X34	10	9	5	3	3	7	2	5	10	6
X35	3	6	7	6	8	1	-	6	9	14

3.3 Data Analysis

Data analysis was conducted to test whether the results of the questionnaires that had been collected were valid and correct data. The data testing carried out in this research is a validity test, reliability test, correlation analysis, and factor analysis performed using IBM SPSS version 26 software tools. Then the risk analysis was carried out by two methods: using a probability impact matrix with MS. Excel software and multiple linear regression analysis with IBM SPSS version 26 software.

3.3.1 Validity Test

A validity test was conducted to measure the accuracy of the instruments used in a study. If the device used to obtain data is valid, then the device can be used to measure what should be measured. The validity test looks at the corrected item's total correlation value. Whether the data is valid or not can be seen by comparing the fixed item-total correlation value from the data with the product-moment r value table, which is as follows:

a. If r count is positive or r count > r table, then the variable is valid
b. If the r count is negative or the r count < r table, the variable is invalid.

The following are the results of the validity test, namely:

Table 3. Validity Test Results

Variabel	Frequency Validity Test			Impact Validity Test		
	r Count	r Table	Explanation	r Count	r Table	Explanation
X1	0,530	0,374	Valid	0,667	0,374	Valid
X2	0,510	0,374	Valid	0,686	0,374	Valid
X3	0,477	0,374	Valid	0,438	0,374	Valid
X4	0,641	0,374	Valid	0,674	0,374	Valid
X5	0,517	0,374	Valid	0,579	0,374	Valid

Variabel	Frequency Validity Test			Impact Validity Test		
	r Count	r Table	Explanation	r Count	r Table	Explanation
X6	0,522	0,374	Valid	0,462	0,374	Valid
X7	0,487	0,374	Valid	0,483	0,374	Valid
X8	0,551	0,374	Valid	0,512	0,374	Valid
X9	0,533	0,374	Valid	0,672	0,374	Valid
X10	0,523	0,374	Valid	0,623	0,374	Valid
X11	0,318	0,374	invalid	0,650	0,374	Valid
X12	0,565	0,374	Valid	0,655	0,374	Valid
X13	0,769	0,374	Valid	0,676	0,374	Valid
X14	0,697	0,374	Valid	0,816	0,374	Valid
X15	0,788	0,374	Valid	0,794	0,374	Valid
X16	0,724	0,374	Valid	0,653	0,374	Valid
X17	0,576	0,374	Valid	0,661	0,374	Valid
X18	0,757	0,374	Valid	0,656	0,374	Valid
X19	0,672	0,374	Valid	0,720	0,374	Valid
X20	0,663	0,374	Valid	0,704	0,374	Valid
X21	0,443	0,374	Valid	0,488	0,374	Valid
X22	0,673	0,374	Valid	0,742	0,374	Valid
X23	0,643	0,374	Valid	0,675	0,374	Valid
X24	0,675	0,374	Valid	0,857	0,374	Valid
X25	0,403	0,374	Valid	0,419	0,374	Valid
X26	0,431	0,374	Valid	0,490	0,374	Valid
X28	0,374	0,374	Valid	0,477	0,374	Valid
X29	0,434	0,374	Valid	0,737	0,374	Valid
X30	0,615	0,374	Valid	0,642	0,374	Valid
X31	0,457	0,374	Valid	0,499	0,374	Valid
X32	0,499	0,374	Valid	0,587	0,374	Valid
X33	0,507	0,374	Valid	0,531	0,374	Valid
X34	0,394	0,374	Valid	0,466	0,374	Valid
X35	0,458	0,374	Valid	0,375	0,374	Valid

From the results of the validity test carried out, of the 34 variables tested, there are 33 variables whose r count > r table and one variable that is r count < r table. This one variable is then eliminated and not included in further data analysis.

3.3.2 Reliability Test

The reliability test was measured using the Cronbach's Alpha method, provided that the Cronbach's Alpha value was more significant than the r obtained from the validity test. This means that if the Cronbach's Alpha value obtained from the calculations with the IBM SPSS ver. 26 software tool is more significant than the r obtained from the validity test, it can be concluded that the questionnaire is reliable. Here are the results of the reliability test:

Table 4. Reliability Test Results

Frequency		Impact	
Cronbach's Alpha	N of Items	Cronbach's Alpha	N of Items
0,930	33	0,947	33

From the reliability test results above, the Cronbach's Alpha value obtained from the IBM SPSS version 26 software tool is for a frequency of 0,930, while for the impact of 0,947, where the two values are more significant than the value of the r table in the validity test, which is 0,374 so that the data obtained can be said to be reliable.

3.3.3 Risk Analysis with Probability Impact Matrix

The risk rating analysis was carried out using the results of the second stage of data collection (Respondent Questionnaire), which had previously been tested for validity and reliability tests. The risk rating analysis is carried out by multiplying the average impact value by the average opportunity value. To calculate the average value of the frequency and the average value of the impact using a weighting taken from the Likert scale, which is as follows:

Table 5. Frequency Scale Table

Frequency Criteria	1	2	3	4	5
	Very rarely	Rarely	Sometimes	Often	Very often
Weighting	0,1	0,3	0,5	0,7	0,9

Table 6. Impact Scale Table

Impact Criteria	1	2	3	4	5
	Very Minor	Minor	Medium	Major	Very Major
Weighting	0,05	0,1	0,2	0,4	0,8

Next, a risk rating will be given based on multiplying the average opportunity value and the average impact value by matching the risk value obtained from the calculation with the probability impact matrix table. The following is an image of the probability impact matrix table:

Table 7. Probability Impact Matrix Table

Probability	Risk Score - Probability x Impact				
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.10	0.20	0.40
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
	Very low	Low	Medium	High	Very High
	Impact				
Explanation :	Low		Medium		High

The results of the calculation of risk analysis with a probability matrix table can be seen in the following table:

Table 8. Probability Impact Matrix Table

Variabel	Frequency (I)	Impact (P)	Risk Value (IxP)	Explanation
X1	0,49	0,36	0,17	Medium
X2	0,53	0,37	0,19	Medium
X3	0,49	0,32	0,15	Medium
X4	0,57	0,41	0,24	High
X5	0,59	0,42	0,25	High
X6	0,59	0,40	0,24	High
X7	0,63	0,39	0,25	High
X8	0,61	0,37	0,22	High
X9	0,51	0,29	0,15	Medium
X10	0,58	0,38	0,22	High
X12	0,48	0,29	0,14	Medium
X13	0,59	0,45	0,27	High
X14	0,49	0,36	0,18	Medium
X15	0,50	0,37	0,19	Medium
X16	0,55	0,42	0,23	High
X17	0,51	0,39	0,20	Medium
X18	0,46	0,32	0,15	Medium

Variabel	Frequency (I)	Impact (P)	Risk Value (IxP)	Explanation
X19	0,49	0,39	0,19	Medium
X20	0,50	0,34	0,17	Medium
X21	0,45	0,34	0,15	Medium
X22	0,49	0,37	0,18	Medium
X23	0,49	0,45	0,22	High
X24	0,43	0,31	0,13	Medium
X25	0,57	0,37	0,21	High
X26	0,55	0,42	0,23	High
X28	0,61	0,45	0,27	High
X29	0,37	0,32	0,12	Medium
X30	0,53	0,37	0,19	Medium
X31	0,50	0,32	0,16	Medium
X32	0,39	0,21	0,08	Medium
X33	0,50	0,29	0,14	Medium
X34	0,37	0,35	0,13	Medium
X35	0,57	0,54	0,30	High

From the calculation results above, it is known that 13 variables are included in the high category because the risk value is in the range of 0,2 – 0,72.

3.3.4 Correlation Analysis

The correlation analysis used Spearman correlation because the data studied were nonparametric with ordinal scale type. Spearman correlation analysis determines the relationship or relationship between two variables measured at least in ordinal. Refer to the correlation coefficient value column (r count) compared with the r table value in the correlation test. For statistical decision-making, it is a variable that has a correlation coefficient > 0,374. The following are the results of the correlation analysis, which are as follows:

Table 9. Correlation Analysis Results

Frequency					Impact				
Variabel	**Correlation Coefficient**	**Sig. (2-tailed)**	**r Table**	**Explanation**	**Variabel**	**Correlation Coefficient**	**Sig. (2-tailed)**	**r Table**	**Explanation**
X1	0,639**	0,000	0,374	Have Correlation	X1	0,641**	0,000	0,374	Have Correlation
X2	0,548**	0,002	0,374	Have Correlation	X2	0,657**	0,000	0,374	Have Correlation
X3	0,498**	0,005	0,374	Have Correlation	X3	0,399*	0,029	0,374	Have Correlation
X4	0,642**	0,000	0,374	Have Correlation	X4	0,527**	0,003	0,374	Have Correlation
X5	0,445*	0,014	0,374	Have Correlation	X5	0,615**	0,000	0,374	Have Correlation
X6	0,443*	0,014	0,374	Have Correlation	X6	0,378*	0,039	0,374	Have Correlation
X7	0,340	0,066	0,374	No Correlation	X7	0,486**	0,006	0,374	Have Correlation
X8	0,273	0,144	0,374	No Correlation	X8	0,506**	0,004	0,374	Have Correlation
X9	0,305	0,101	0,374	No Correlation	X9	0,636**	0,000	0,374	Have Correlation
X10	0,349	0,058	0,374	No Correlation	X10	0,644**	0,000	0,374	Have Correlation
X12	0,404*	0,027	0,374	Have Correlation	X12	0,669**	0,000	0,374	Have Correlation
X13	0,708**	0,000	0,374	Have Correlation	X13	0,594**	0,001	0,374	Have Correlation
X14	0,633**	0,000	0,374	Have Correlation	X14	0,734**	0,000	0,374	Have Correlation
X15	0,766**	0,000	0,374	Have Correlation	X15	0,710**	0,000	0,374	Have Correlation
X16	0,685**	0,000	0,374	Have Correlation	X16	0,428*	0,018	0,374	Have Correlation
X17	0,501**	0,005	0,374	Have Correlation	X17	0,453*	0,012	0,374	Have Correlation
X18	0,662**	0,000	0,374	Have Correlation	X18	0,597**	0,000	0,374	Have Correlation
X19	0,474**	0,008	0,374	Have Correlation	X19	0,531**	0,003	0,374	Have Correlation
X20	0,536**	0,002	0,374	Have Correlation	X20	0,466**	0,010	0,374	Have Correlation
X21	0,317	0,088	0,374	No Correlation	X21	0,272	0,146	0,374	No Correlation
X22	0,468**	0,009	0,374	Have Correlation	X22	0,650**	0,000	0,374	Have Correlation
X23	0,517**	0,003	0,374	Have Correlation	X23	0,489**	0,006	0,374	Have Correlation
X24	0,728**	0,000	0,374	Have Correlation	X24	0,768**	0,000	0,374	Have Correlation
X25	0,475**	0,008	0,374	Have Correlation	X25	0,337	0,069	0,374	No Correlation
X26	0,436*	0,016	0,374	Have Correlation	X26	0,429*	0,018	0,374	Have Correlation
X28	0,197	0,297	0,374	No Correlation	X28	0,34	0,066	0,374	No Correlation
X29	0,387*	0,035	0,374	Have Correlation	X29	0,594**	0,001	0,374	Have Correlation
X30	0,478**	0,008	0,374	Have Correlation	X30	0,623**	0,000	0,374	Have Correlation
X31	0,326	0,079	0,374	No Correlation	X31	0,452*	0,012	0,374	No Correlation
X32	0,574**	0,001	0,374	Have Correlation	X32	0,572**	0,001	0,374	Have Correlation
X33	0,512**	0,004	0,374	Have Correlation	X33	0,547**	0,002	0,374	Have Correlation
X34	0,333	0,072	0,374	No Correlation	X34	0,484**	0,007	0,374	Have Correlation
X35	0,282	0,130	0,374	No Correlation	X35	0,19	0,315	0,374	No Correlation

Based on the results of the correlation analysis with the significance of the relationship, it is known that from 33 variables, 23 variables correlate.

3.3.5 Factor Analysis

Factor analysis is intended to find the main factors of time performance that affect project implementation time, which can be taken from the weight of the most significant contribution of the other elements.

3.3.5.1 Assessing The Eligibility of Variables

KMO test and Bartlett's Test are used for initial tests on whether the existing data can be broken down into several factors; the results of the analysis can be seen in the following table:

Table 10. Results of KMO and Bartlett's Test

KMO and Bartlett's Test Frequency			KMO and Bartlett's Test Impact		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,613	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,580
Bartlett's Test of Sphericity	Approx. Chi-Square	575,574	Bartlett's Test of Sphericity	Approx. Chi-Square	633,986
	df	253		df	253
	Sig.	0		Sig.	0

The table above shows that the results show that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0,613 for the frequency scale and 0,580 for the impact scale, which means more than 0,5 then. The correlation is quite significant between variables. Furthermore, the Anti-Image Matrices Results table shows the correlation between independent variables. The value to be considered is the MSA (Measure of Sampling Adequacy), ranging from 0 to 1, with the criteria that if the MSA value is <0,5, then the variable cannot be predicted and cannot be analyzed further, while if the MSA value is > 0.5, the variable is still predictable and can be analyzed further. The following are the output results of Anti-Image Matrices, which are as follows:

Table 11. Anti-Image Matrices output results

Frequency			Impact		
Variabel	MSA Value	Explanation	Variabel	MSA Value	Explanation
X1	0,740	Can Be Analyzed	X1	0,563	Can Be Analyzed
X2	0,729	Can Be Analyzed	X2	0,630	Can Be Analyzed
X3	0,572	Can Be Analyzed	X3	0,531	Can Be Analyzed
X4	0,689	Can Be Analyzed	X4	0,771	Can Be Analyzed
X5	0,592	Can Be Analyzed	X5	0,449	Cannot be Analyzed
X6	0,667	Can Be Analyzed	X6	0,358	Cannot be Analyzed
X12	0,479	Cannot be Analyzed	X12	0,501	Can Be Analyzed
X13	0,698	Can Be Analyzed	X13	0,652	Can Be Analyzed
X14	0,691	Can Be Analyzed	X14	0,706	Can Be Analyzed
X15	0,768	Can Be Analyzed	X15	0,526	Can Be Analyzed
X16	0,719	Can Be Analyzed	X16	0,603	Can Be Analyzed
X17	0,468	Cannot be Analyzed	X17	0,484	Cannot be Analyzed
X18	0,654	Can Be Analyzed	X18	0,714	Can Be Analyzed
X19	0,660	Can Be Analyzed	X19	0,842	Can Be Analyzed
X20	0,581	Can Be Analyzed	X20	0,690	Can Be Analyzed
X22	0,768	Can Be Analyzed	X22	0,631	Can Be Analyzed
X23	0,556	Can Be Analyzed	X23	0,515	Can Be Analyzed
X24	0,600	Can Be Analyzed	X24	0,682	Can Be Analyzed
X26	0,335	Cannot be Analyzed	X26	0,648	Can Be Analyzed
X29	0,585	Can Be Analyzed	X29	0,752	Can Be Analyzed
X30	0,448	Cannot be Analyzed	X30	0,545	Can Be Analyzed
X32	0,527	Can Be Analyzed	X32	0,416	Cannot be Analyzed
X33	0,451	Cannot be Analyzed	X33	0,311	Cannot be Analyzed

From the results of Anti-Image Matrices, there are eight variables whose MSA value is <0,5, so these variables cannot be predicted and cannot be analyzed further. While there are 15 variables whose MSA value is > 0,5, the variables are still predictable and can be investigated further.

3.3.6 Factor Analysis

Multiple linear regression analysis aims to determine whether or not there is an effect of two or more independent variables (X) on the dependent variable (Y). It is also a set of statistical procedures to explain the linear relationship between two or more independent variables (X1, X2,….Xn) and the dependent variable (Y).

3.3.6.1 Coefficient of Determination Test (R^2-Test)

In the measurement, the coefficient of determination has a range of 0% - 100%. If the coefficient of determination is close to 100%, it means that the independent variable (X) in the study has a significant influence on the dependent variable (Y). The results obtained from the determination test can be seen in the table below:

Table 12. Results of the Coefficient of Determination

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,807[a]	0,652	0,639	0,408
2	0,899[b]	0,807	0,793	0,309
3	0,922[c]	0,85	0,832	0,278
4	0,940[d]	0,884	0,866	0,249
5	0,951[e]	0,904	0,884	0,231
6	0,950[f]	0,903	0,888	0,227

a. Predictors: (Constant), X14
b. Predictors: (Constant), X14, X20
c. Predictors: (Constant), X14, X20, X15
d. Predictors: (Constant), X14, X20, X15, X18
e. Predictors: (Constant), X14, X20, X15, X18, X13
f. Predictors: (Constant), X20, X15, X18, X13

From the table above, the results of the coefficient of determination test show that there are six regression models produced; however, the best regression model is regression model 5, which consists of 5 variables, because it has an R2 value that is greater than other regression models, which is 0.904, which means that the variability of the dependent variable which the variability of the independent variable can explain is 90.4%.

3.3.6.2 Test (F-Test)

A simultaneous test off-test is carried out to know whether the independent variable (X) simultaneously (together) affects the dependent variable (Y), namely the risk of time delays that occur. The results obtained from the Simultaneous test can be seen in the table below:

Table 13. Simultaneous Test Results

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8,712	1	8,712	52,404	.000[b]
	Residual	4,655	28	0,166		
	Total	13,367	29			
2	Regression	10,793	2	5,397	56,615	.000[c]
	Residual	2,574	27	0,095		
	Total	13,367	29			
3	Regression	11,357	3	3,786	48,964	.000[d]
	Residual	2,01	26	0,077		
	Total	13,367	29			
4	Regression	11,82	4	2,955	47,747	.000[e]
	Residual	1,547	25	0,062		
	Total	13,367	29			
5	Regression	12,084	5	2,417	45,229	.000[f]
	Residual	1,282	24	0,053		
	Total	13,367	29			
6	Regression	12,074	4	3,018	58,371	.000[g]
	Residual	1,293	25	0,052		
	Total	13,367	29			

a. Dependent Variable: Y
b. Predictors: (Constant), X14
c. Predictors: (Constant), X14, X20
d. Predictors: (Constant), X14, X20, X15
e. Predictors: (Constant), X14, X20, X15, X18
f. Predictors: (Constant), X14, X20, X15, X18, X13
g. Predictors: (Constant), X20, X15, X18, X13

From the table above, the calculated F value obtained in regression model 5 is 45,229, and the F table value with a 95% confidence level obtained is 2,74. This indicates that F count > F table, the significance value is less than 0,05, which is 0,000, which means a significant influence. It can be concluded that the independent variables simultaneously affect the dependent variable.

3.3.6.3 Partial Test (T-Test)

A partial test (T-test) is one of the research hypothesis tests that aims to determine whether the independent variable or independent variable (X) partially (alone) affects the delay. The results obtained from the partial test can be seen in the table below:

Table 14. Partial Test Results

Coefficients[a]

Model				Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,895	0,243		7,811	0,000
	X14	0,482	0,067	0,807	7,239	0,000
2	(Constant)	1,154	0,243		4,756	0,000
	X14	0,383	0,055	0,641	6,996	0,000
	X20	0,310	0,066	0,428	4,673	0,000
3	(Constant)	0,828	0,250		3,316	0,003
	X14	0,294	0,059	0,492	4,964	0,000
	X20	0,254	0,063	0,351	4,021	0,000
	X15	0,226	0,084	0,281	2,700	0,012
4	(Constant)	0,589	0,240		2,458	0,021
	X14	0,155	0,073	0,260	2,112	0,045
	X20	0,196	0,060	0,271	3,253	0,003
	X15	0,285	0,078	0,355	3,658	0,001
	X18	0,208	0,076	0,296	2,735	0,011

Coefficients[a]

Model				Standardized Coefficients Beta	t	Sig.
5	(Constant)	0,168	0,293		0,573	0,572
	X14	0,038	0,086	0,063	0,440	0,664
	X20	0,148	0,060	0,205	2,464	0,021
	X15	0,328	0,075	0,408	4,374	0,000
	X18	0,248	0,073	0,353	3,403	0,002
	X13	0,178	0,080	0,212	2,226	0,036
6	(Constant)	0,099	0,243		0,406	0,688
	X20	0,139	0,056	0,192	2,500	0,019
	X15	0,348	0,059	0,432	5,877	0,000
	X18	0,269	0,052	0,384	5,149	0,000
	X13	0,199	0,062	0,237	3,203	0,004

In the table above, regression model 5 shows that four independent variables affect the dependent variable: the significance value < 0,05 or the calculated T value > T table, where the T table value = 2,06390. So it can be concluded that the variable Y (Risk of Time Delay Occurs) is influenced by the variable X15 (Material Order Timeliness), X18 (Limited Availability of Materials in the Market), and X20 (Low Equipment Productivity), dan X13 (Material Delivery Delay).

3.4 Third Stage Data Collection

From the data analysis carried out on the results of the second stage of data collection, it was found that the factors that influence the risk of time delays in the work of the Pulogadung-East Jakarta PIK Flats Construction Project. There are four influential variables from multiple linear regression analysis, while 13 variables are included in the high-risk category from a risk-ranking study using the probability impact matrix table. Furthermore, the third stage of data collection is carried out, namely the validation of risk handling experts; this is done by distributing questionnaires to experts and conducting interviews with experts, which aims to ask for opinions from experts regarding whether or not the expert agrees with the results obtained from the second stage of data collection and asks for input from experts regarding the handling actions that need to be taken so that the risk of time delays that occur does not get more prominent or can be resolved. In this final stage, expert validation, if the expert agrees with the variable, it is given a value of 1, while if the expert does not decide, it is given a value of 0. The following is the date of the third stage of data collection:

Table 15. Results of Third Stage of Data Collection

Variabel		Expert Results					Value	Explanation
		PL1	PL2	PL3	PL4	PL5		
Labor Factor								
X4	Low Work Productivity	0	0	0	0	1	1	Not Agree
X5	Lack of Coordination at Work	0	1	1	0	1	3	Agree
X6	Workers Ignore Work Safety and Security	0	0	0	0	1	1	Not Agree
Job Document Factor								
X7	Design Change	1	1	1	0	1	4	Agree
X8	Changing Work Schedule	0	0	0	1	1	2	Not Agree
X10	Late Submission of Design Changes	0	0	0	1	0	1	Not Agree
Material Factor								
X13	Delay in Material Delivery	0	1	0	0	1	2	Not Agree
X15	Material Order Timeliness	0	1	1	0	1	3	Agree
X16	Lack of Construction Materials	0	0	0	0	1	1	Not Agree
X18	Limited Availability of Materials in the Market	1	1	0	0	1	3	Agree
Tool Factor (Machine)								
X20	Low equipment productivity	0	1	0	0	1	2	Not Agree
X23	Heavy equipment damage	0	0	0	0	1	1	Not Agree
Cost Factor (Money)								
X25	There is a delay in payment to subcontractors through the main contractor	1	0	0	1	0	2	Not Agree
X26	Funding problems from head office (Contractor)	1	0	0	1	0	2	Not Agree
X28	Late payment term by owner	1	1	1	1	1	5	Agree
Other Factors								
X35	The outbreak of the corona virus (Covid 19)	1	1	0	1	0	3	Agree

From the table above, it can be seen that the expert agreed on 6 of the 16 variables proposed to the expert as factors that caused the risk of time delays in the work of the Pulogadung-East Jakarta PIK Flats Construction Project. Meanwhile, the dominant factor that causes the risk of time delays in the work of the Pulogadung Flats Project, East Jakarta, is the cost factor with the variable Late Payment of Term By Owner (X28) because it has the highest score of 5 and has been approved by experts.

Furthermore, the handling actions that need to be taken are described for the emergence of variables/factors that cause the risk of time delays so that the risk of time delays that occur does not increase or can be overcome, namely as follows:

Table 16. Actions for Handling Expert Recommendations

Variabel		Expert	Handling Action
X5	Lack of Coordination at Work	PL1	Can be anticipated by coordinating the linkages between jobs appropriately.
		PL2	Contractors (Maincont) must regularly hold coordination meetings with their sub-contractors to avoid unloading during work.
		PL3	Conducted internal work evaluation.
		PL4	Following the schedule, weekly, monthly targets, and checking for existing problems.
		PA1	Good coordination will certainly reduce the risk of delays. Good communication is one way.
X7	Design Change	PL1	Design changes at the time of implementation may delay the implementation schedule. It is advisable to do this before the work is carried out.
		PL2	Design changes do exist but they are minor, the owner's approval makes it slow.
		PL3	Created Shop Drawing and Design Review.
		PL4	It should be predictable from the start.
		PA1	Make changes early in the project and avoid changes when the project is already running. The longer the project has been running and there are design changes, the more costs will be incurred.
X15	Material Order Timeliness	PL1	Make a material schedule which includes the time for ordering materials.
		PL2	The material orderer (contractor) must properly understand the work implementation schedule, so that he knows when the material is ordered, and when the material arrives.
		PL3	Created a schedule for procurement/ordering of materials.
		PL4	Scheduling of material orders must be strict.
		PA1	Anticipate ordering time for materials that do take a long time in the manufacturing/shipping process.
X18	Limited Availability of Materials in the Market	PL1	The availability of materials in the market can hamper implementation time because it depends on third parties.
		PL2	The contractor wrote to the owner and stated that the materials were no longer produced, so the owner could propose a replacement without reducing the specs/quality.
		PL3	Order materials in advance and make a delivery schedule.
		PL4	Market conditions can be seen, unless unpredictable conditions occur.
		PA1	If the material is rarely marketed, it means that you have to place an order from the beginning to anticipate.
X28	Late payment term by owner	PL1	Late payment will definitely affect the time delay that occurs, because it involves the contractor's cashflow and payments to subcontractors.
		PL2	The contractor must send a letter to the owner explaining the conditions of the project, so that the payment terms are accelerated.
		PL3	Anticipating the implementation of urgent work takes precedence.
		PL4	The owner must be able to reschedule the budget and transfer the budget during a pandemic condition like this, so that the ongoing development continues smoothly.
		PA1	Must make back-to-back payments to vendors/sub-contractors so as not to disrupt cash flow. If this is not possible, they must seek funding to cover payments to their vendors/sub-contractors.
X35	The outbreak of the corona virus (Covid 19)	PL1	The Covid-19 (pandemic) outbreak is an unexpected event, having a negative impact on various aspects including delays in construction work. Health protocols are only able to minimize the risk, which is high in lockdown/project stops.
		PL2	To avoid/minimize the risk, it is necessary to increase the supervision of the process so that the workforce is not exposed to COVID-19 and there is a lockdown/the project stops.
		PL3	Carry out the 5M health protocol more strictly.
		PL4	Unpredictable, there must be cooperation with various other government agencies.
		PA1	-

4. Conclusion

Based on the results of the analysis and discussion of the data that has been carried out in the previous chapter, several conclusions can be drawn as follows:

1. From the 2 data analysis methods that have been carried out in the previous chapter, it is known what factors cause the risk of time delays that occur in the work of the Pulogadung-East Jakarta PIK Flats Construction Project, which is as follows:
   a. From multiple linear regression analysis obtained, 1 factor that affects the risk of time delays occurs, namely the material factor, and the influencing factor is the timeliness of ordering materials (X15) and limited availability of materials in the market (X18).
   b. From the impact probability matrix table, four factors influence the risk of time delays: the labor factor and the influencing factor is Lack of Coordination at Work (X5) work document factors. Those that influence are Design Change (X7), cost factors, and those that influence are Late Payment Term by Owner (X28), and Other factors, and those that influence are Corona Outbreak (Covid 19) (X35) [14] [15].
2. The most dominant factor that causes the risk of time delays in the Pulogadung-East Jakarta PIK Flats Construction Project's work is the cost factor with variable Late Payment Term by Owner (X28) because it has the highest score of 5 and has been approved by experts.
3. Handling actions that need to be taken for the most dominant factor causing the risk of time delays that occur in the Pulogadung-East Jakarta PIK Flats Development Project work, namely Late Payment Term by Owner (X28), that is by setting a work schedule with urgent work to be done first. Less critical work is needed to save costs before the owner pays the term. And also, the contractor can send a letter to the owner regarding an explanation of the field/project conditions so that the owner can accelerate the payment of the term and the work can continue.

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