VOLUME 21 | NUMBER 01 | JULY 2021
https://ejournal.worldconference.id/index.php/neutron
E-ISSN: 2685-3272 | P-ISSN 1412-0860

Risk Analysis of Delay in The Construction Project (in The Project for The Construction of A Public Junior High School 1 Surabaya)

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Abstract

The complex problems that existed during the Field Implementation in the SMP Negeri 1 Surabaya project at that time caused some work that was not as planned both in terms of time, quality and cost which resulted in overbudget and overtime. When experiencing overbudget and overtime, it is necessary to have good cost, quality and time management. Good management should not only be owned by the project owner. The length of time to complete the project has a big effect on the increase in the overall project cost. Therefore, daily, weekly and monthly progress reports are needed to report work results and completion times for each project work item. Furthermore, this work is compared with the completion time of the plan so that the completion time can be controlled for each period. This is because the construction of the building has a delay in time so that it can cause disruption in some field operations. The analysis that I have done is viewed from all of them (owner and contractor). This study uses the AHP (Analytical Hierarchy Process) research method because AHP is used to derive the ratio scale of several paired comparisons that are discrete or continuous. Other problems such as inconsistencies in planners, supervisors, executors, and other authorities in the field, namely lack of communication and late making decisions such as changes in design and changes in calculations that are in implementation and planning so that the project results in time and cost delays, and other problems. such as material calculations and others, there are also delays caused by delays in making decisions in implementation. Because of that, the project for the Public Junior High School 1 in Surabaya experienced delays in several jobs, namely the foundation, column, ladder, and beam work, which should have been done in 1-2 months to 3-4 months. In terms of implementation, such as lack of communication between planners, supervisors and implementers as well as other authorized officials, a good communication is needed. So that it does not cause so many problems and can reduce delays in terms of implementation in the field.

Keywords
AHP (Analytical Hierarchy Process), Delay Factors

1. INTRODUCTION

Delays in implementation of one activity in the project can cause delays in other activities. This has an impact on delays in completing a project as a whole. The delay is mentioned in Presidential Regulation No. 54 of 2010 articles 120 and No. 70 of 2012 article 120, namely goods / services providers who are late in completing work within the period stipulated in the contract, will be subject to a late penalty of 1/1000 (one thousandth) of the contract price for each day of delay, and do not exceed the amount of performance guarantee. The delay will also affect the termination of the employment contract as stated in Presidential Regulation No. 54 of 2010, namely PPK can 1. unilaterally terminate the contract if the penalty for late implementation of the work has exceeded 5% (five percent) of the contract value. construction service. Therefore, construction service companies need to identify factors that cause delays in the completion time, so that the project can run as planned.

The purpose of this research is to analyze the important factors that influence project delays using the Analytical Hierarchy Process method, to find out the factors that are the risk of delays in construction projects at Junior High School 1 Surabaya, to find out the dominant risk factors that cause construction project delays in the construction of State Junior High Schools 1 Surabaya, Knowing the risk mitigation carried out to minimize project delays.

2. RESEARCH METHODOLOGY

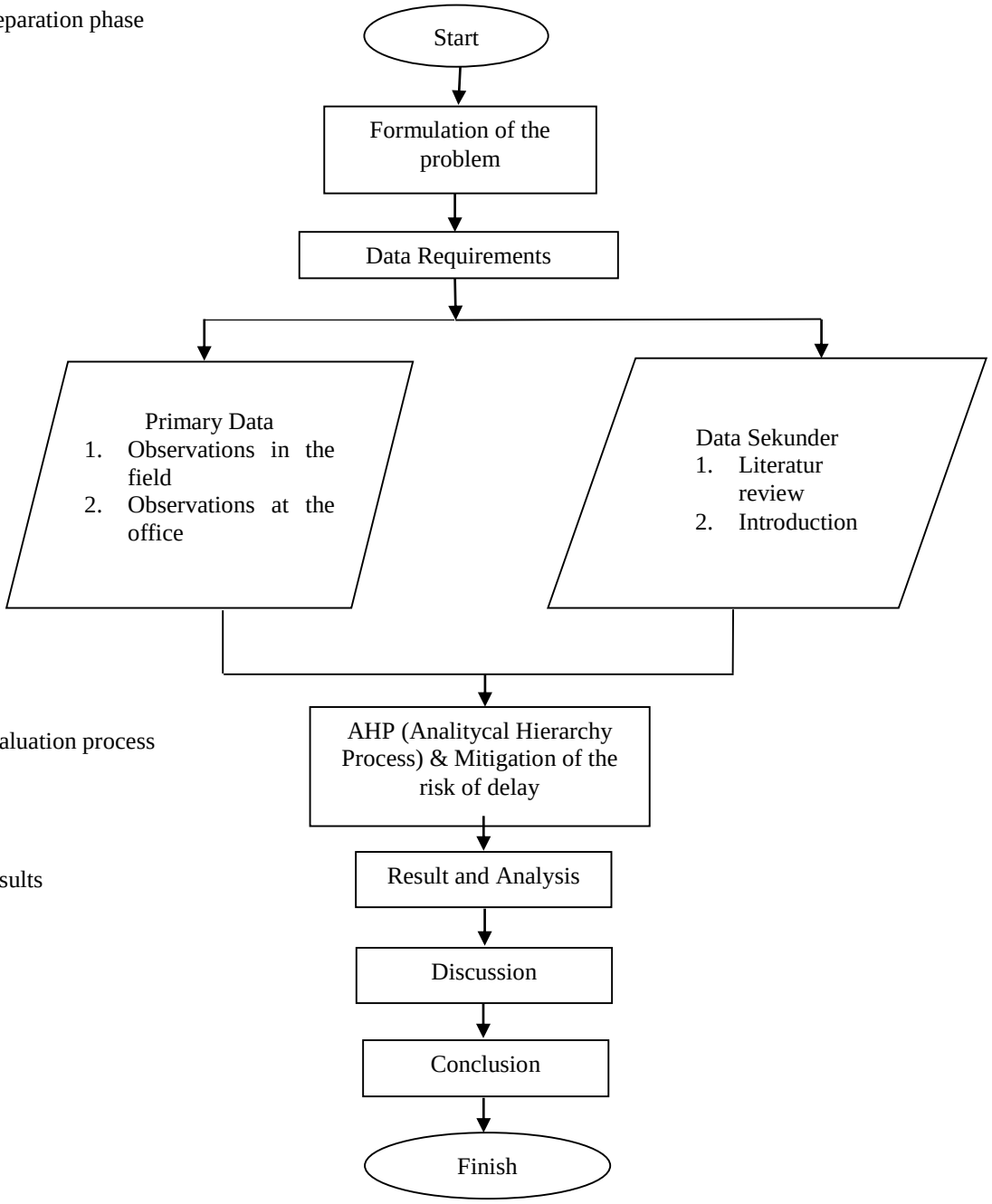
The method used in this research is descriptive and analytical methods. Analysis means that existing data are processed in such a way as to produce a conclusive conclusion. While descriptive means by describing the problems that already exist or appear. Analysis of data using AHP (Analytical hierarchy process), namely the theory of

measurement through a comparison matrix to get priority scale values. After getting a priority scale, the data is then discussed and conclusions drawn(Mustari & Rahman, 2012).

2.1. **Research Flowchart**

The following is a research methodology flow chart:

4. Preparation phase



5. Evaluation process

6. Results

Figure 1. Research Flowchart

3. DISCUSSION AND ANALYSIS

In the AHP method, the criteria are arranged in a hierarchical form. The first analysis in this study is the calculation of the criteria weight using the AHP method. There are 3 work steps in using the AHP method, namely: looking for geomes, pairwise comparison matrix, and data normalization(Syah, 2014). In processing the data to determine the factors causing the delay, interviews were conducted with the research advisors in the related

companies and the results of field observations so that 6 main factors were found to be the cause of delays in development projects. The factors causing the delay can be seen in the following table(Hassan, 2016).

Table 1. The factors causing the delay

Variable	Code	Information
Design drawing changed	X1	Change in the location of the material / equipment Change in material / equipment size Adding material / equipment components
Procurement of materials is hampered	X2	Old material production process Long duration of material delivery Poor material quality Size and specifications not on the market The product received is defective
Limited equipment	X3	Limited company entry Limited equipment Power outage Low efficiency of equipment The equipment is damaged
Worker limitations	X4	The number of workers is less Many employees are retiring Employee recruitment is limited Inadequate worker experience Accidents at work
Bad management	X5	Lack of appreciation from the company An accident while going to work Family problems Sudden permission Project licensing issues (legal) The plan schedule was not realized Poor coordination between owners, contractors, and consultants
Financial factor	X6	Job evaluation was not carried out Financial difficulties experienced by contractors Financial problems experienced by the owner Delay in payment processing Increase in material prices

3.1. Analytical Hierarchy Process (AHP)

After these factors are found, the next step is to conduct an AHP questionnaire which aims to rank the factors causing the delay.

3.2. Determining the Hierarchical Structure

In determining the maintenance strategy, first of all, we must first know what is meant by the AHP hierarchy. The AHP hierarchy is a propagating chart with the order of the top to the bottom chart, which are objectives, criteria, sub-criteria (if needed), and alternatives. The following is an explanation of the chart:

a. Purpose: The aim in processing AHP this time is to determine the factors causing the delay with the highest ranking.
b. Criteria and Sub-Criteria: Criteria and Sub-criteria are the basis necessary for an objective to affect the objective directly.

c. Alternative: Alternative is a form of the lowest level that affects a criterion and indirectly affects the goal. Then it can be seen the form of AHP hierarchy consisting of Objectives, Criteria, and Alternatives which form the following chart:

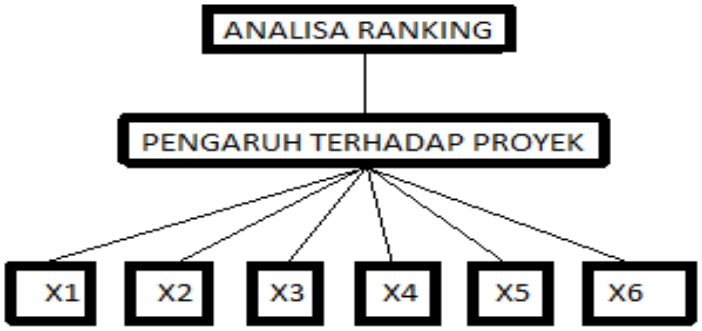


Figure 2. AHP Hierarchy

By looking at the AHP's goals, it only needs to include one factor, namely "Influence on the project" with the criteria in table 4.1 so that there are 6 factors that cause delays, which will be compared through questionnaires distributed to respondents.

3.3. Performs an Alternative comparison score

After the questionnaire data is obtained, the next step is to do a Pairwise Comparison comparing X1, X2, X3, X4, X5, and X6 to determine the size of the effect on the delays in the topside platform project. The amount of scoring on the questionnaire is described in table 4.3:

Table 2. Scale of weighting importance

Intensity of Interest	Definition
1	Both elements / alternatives are equally important
3	Element A is slightly larger than element B (Moderate)
5	Element A is greater than Element B (Strong)
7	Element A is clearly larger than element B (verystrong)
9	Element A is absolutely greater than element B (Extreme strong)
2, 4 ,6 ,8	The values between two adjacent balances

After processing the questionnaire data, a geomean is obtained with the values:
Source: Processed data

a. X1/X2=5,58
b. X1/X3=0,33
c. X1/X4=0,80
d. X1/X5=0,23
e. X1/X6=0,87
f. X2/X3=4,08
g. X2/X4=2,55
h. X2/X5=0,32
i. X2/X6=3
j. X3/X4=3
k. X3/X5=0,39
l. X3/X6=3
m. X4/X5=0,33
n. X4/X6=0,33

Then the data above is formed in the following table 3. matrix:

Table 3. Pair Wise Comparison Matrix

	X1	X2	X3	X4	X5	X6
X1	1	5,8	0,33	0,80	0,23	0,87
X2	5,58	1	4,08	2,55	0,32	3,00
X3	0,33	4,08	1	3,00	0,39	3,00
X4	0,80	2,55	3,00	1	0,33	0,33
X5	0,23	0,32	0,39	0,33	1	3,00
X6	0,87	3,00	3,33	0,33	3,33	1
Total	8,81	16,53	11,80	8,02	5,28	11,20

1. Weighting Criteria

Weighting of the criteria is done by normalizing the matrix from the previous pair wise comparison matrix.

Table 4. Normalization Matrix

	X1	X2	X3	X4	X5	X6	amount	Weight normalization
X1	0,11	0,34	0,03	0,10	0,04	0,08	0.70	0,12
X2	0,63	0,06	0,35	0,32	0,06	0,27	1,69	0,28
X3	0,04	0,25	0,08	0,37	0,07	0,27	1,09	0,18
X4	0,09	0,15	0,25	0,12	0,06	0,03	0,72	0,12
X5	0,03	0,02	0,03	0,04	0,19	0,27	0,58	0,10
X6	0,10	0,18	0,25	0,04	0,57	0,09	1,23	0,21
								1,00

From the results above, then corrected by adding the total weight, namely 0.12 + 0.28 + 0.18 + 0.12 + 0.10 + 0.21 = 1, it can be concluded that the results of the above calculations are correct.

Based on the research results, the combined priorities of all respondents show that the main factor causing the delay in project completion is the method factor criteria, namely the procurement of material is hampered by a weight of 0.12 or equal to 28.09%. Then followed by the second factor, namely the financial factor with a weight of 0.21 or equal to 20.57%, the third priority is limited equipment with a weight of 0.18 or equal to 18.09%, the fourth priority is limited workers with a weight of 0.12 or the same. with 11.95%, then the fifth priority is changing the design image with a weight of 0.12 or equal to 11.67% and the sixth priority is bad management with a weight of 0.10 or equal to 9.63%.

4. CONCLUSIONS AND SUGGESTIONS

4.1. Conclusion

Based on the results of research using a cause-and-effect diagram approach and the AHP method regarding the evaluation of the factors causing the delay in the completion of a construction project at Junior High School 1 Surabaya, it can be concluded that:

1. There are 6 factors that influence the delays of the Junior High School 1 Surabaya project, namely changing design drawings, hampered material procurement, limited equipment, limited workers, poor management and financial factors.
2. The dominant or most dominant factor causing delays in the project of SMP Negeri 1 Surabaya is the material procurement is hampered with a weight of 0.12 or equal to 28.09%. Then followed by the second factor, namely the financial factor with a weight of 0.21 or equal to 20.57%, the third priority is limited equipment with a weight of 0.18 or equal to 18.09%, the fourth priority is limited workers with a weight of 0.12 or the same. with 11.95%,

then the fifth priority is changing the design image with a weight of 0.12 or equal to 11.67% and the sixth priority is bad management with a weight of 0.10 or equal to 9.63%.

3. The risk mitigation carried out to minimize the occurrence of delays in the Junior High School 1 Surabaya project from each of the factors causing the delay are as follows:
    1) Procurement of materials is hampered
    That the procurement of materials is hampered due to errors in logistics and procurement of goods. In this case, it is necessary to analyze the timing of procurement and storage of goods in the warehouse. So that when the inventory runs out, the logistics department will immediately procure it.
    2) Financial factor
    In this case the marketing, financial and legal departments have to make observations from previous projects.
    3) Limited equipment
    In this case, it is necessary to collect data on the need for equipment to support the fabrication process. So that the company can find out the production capacity and can divide the work between sub contractors and vendors
    4) Worker limitations
    It is necessary to collect employee data to determine the welfare they experience. So that worker productivity is better.
    5) Design drawing changed
    This is common in construction projects, it's just that it requires cooperation from both parties so that when a design change occurs, the contractor can immediately provide a solution and the owner also immediately approves the change in the image.
    6) Bad management
    The marketing, legal and licensing departments need to be improved, because bad management can affect work in the field. Therefore it is necessary to make observations to find out deficiencies in subsequent projects.

4.2. SUGGESTION

1. For the contractor to pay more attention to material procurement. So in this case it is necessary to analyze the timing of procurement and storage of goods in the warehouse. this must be considered because if this problem occurs, it certainly causes losses in the form of, greater costs, longer time and less quality of a building.
2. For further research, researchers can use other criteria in accordance with other project delay objects. In addition to determining the priority factors for project delays, the AHP method can also be used to solve other multi-criteria problems that aim to support decision making. In addition, to reduce the subjectivity of respondents' assessments, especially to reduce inaccuracy and uncertainty of respondents in mapping their perceptions into numerical numbers, researchers can use other methods.

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