A Study on Drinking Water Distribution Project in Banda Aceh

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Abstract. The goal of a construction project is to be able to carry out the construction project on time with the budget that matches the plan. However, due to several factors, cost overruns often emerge when executing a project. The purpose of this study is to analyze the dominant factor which leads to cost overruns on the drinking water distribution project in Banda Aceh. This study used primary data that were obtained by distributing questionnaires to contractors that are registered in LPJK company association of Aceh in 2020 and have ever been involved in the installation of drinking water pipes in Banda Aceh between 2015-2020. The population of this research was 62 contractors. By using Slovin equations, 54 contractors were selected as a sample of this research for a 5 percentile margin of error. The dominant factor that leads to cost overruns in drinking water distribution projects in Banda Aceh was caused by cost estimation factor with a mean value of 4,417. This indicates that based on the perception of the contractors, the dominant factor which lead to cost overruns in drinking water distribution projects in Banda Aceh was caused by cost estimation factor.

1. Introduction

Nowadays, in the city of Banda Aceh, the needs of drinkable water grows higher every day. This needs intensify the construction of drinking water distribution projects in Banda Aceh. However, the construction of the drinking water construction projects frequently suffers from technical difficulties on the field, which causing cost overruns at the stage of its implementation. Therefore, a sum of money was required as a contingency fund that acts as a backup fund in facing the uncertainty related to the construction projects [1].

The issues that happened frequently is that an estimator often miscalculate the contingency fund. This often happened due to the lack of information from previous project experience. In order to minimize this funding, aside from counting the estimation correctly, contractors can also complement both vagueness and lacks of information by discussing directly with the project owner and related parties so that the correct estimation cost could be acquired [2]. Based on the described background, the purpose of this study is to identify the dominant factor that cause cost overruns in drinking water distribution projects in Banda Aceh.

The scope of this research is, by utilizing the primary data from questionaires survey with targeted respondents from sub field S1008 with K3, M1, and M2 qualifications. The population of this research was 62 contractors. By using Slovin equations, 54 contractors were selected as a sample of this research for a 5 percentile margin of error. Sampling technique that was used in this research is purposive sampling techniques, which is a technique that purposefully taking out a sample from the population with certain considerations [10]. Its considerations are based on the registered contractors within LPJK company associations of Aceh in 2020 and have ever been involved in the installation of...
drinking water pipes in Banda Aceh between 2015-2020. The data analysis of this research were done with the helped of SPSS (Statistical Product and Service Solution) 24. The benefits of this research for the contractors, mainly for contractors in the field of drinking water distribution is being able to find out the most dominant factor that caused cost overruns, so that they can minimize the risk of running into cost overruns when exercising a project.

2. Methodology

The theories that were used in this research consists of Grand Theory, Middle Theory, and Applied theory, as summarized in figure 1.

![Figure 1. Research Theory Identification](image)

2.1. Project Cost Management

Project cost management includes the process of planning, forecasting, budgeting, and managing. Management cost and controlling so that the project could be completed within the agreed budget. Project cost management includes [3]:

a. Plan cost management
b. Estimate costs
c. Determine budget
d. Control costs

2.1.1. Plan Cost Management

Plan cost management is a process of defining on how cost management will be predicted, budgeted, managed, monitored, and managed. The main benefit of this process is to give guidance and instructions on how the management fund will be organized throughout the project. This process was only done once in the determined point of a project [3].

2.1.2. Estimate Costs

Costs estimation is a quantitative assessment of a possible cost needed to complete an assigned project. It also serves a purpose of counting the contingency to assess the identifiable risk, and the backup fund needed to cover the job. Estimated costs can be presented in both summarized and detailed version [3].

2.1.3. Determine Budget

Budget determining is a process of integrating the individual activity cost or work package to determine an official cost of a project. The main advantage from this process is to draw the line of the controlled cost [3].

2.1.4. Cost Controlling

Cost controlling is a process of observing the cost project status and supervising the change in determined fund. The profit that could be gained from this process that cost determining controlled the project spending. This process was done throughout the entire project [3].
2.2. Cost Overruns

Cost overruns is a construction project fee which, during the implementation process, exceeded the initial cost that has been set at the earliest stage of a project, which resulted in significant lost for the contractors [4]. The risk factor that causes cost overruns is change order [13].

The factors that causing cost overruns are divided into 10 variables. All 10 variables are cost estimation, execution and working relations, documental aspects of the project, material, labour force, equipment, financial aspect of the project, time of conduct, environment and economic viability [5]. The factors that cause cost overruns are sorted out into 10 variables. All 10 variables are economic factor, social and cultural factor, government administration, labour force, material, design and planning, execution and working relations, equipment, field condition, and unexpected factor [6].

2.3. Factors Causing Cost Overruns

Cost overruns in a construction project happened due to several factors, the factors which are causing cost overruns in construction project from previous researcher has been summarized into 49 factors as can be seen in table 1.

| Table 1. Factors which cause cost overruns in a project |
|---------------------------------------------------------|
| Cost estimation                                       |
| - Incomplete data and project information [7]          |
| - Does not take into account the effects of inflation and escalation [7] |
| - Does not take into account the risks factor on location and construction [7] |
| - Lacking accuracy in cost estimation [7]              |
| Execution and working relations                        |
| - High frequency of change in implementation [7]       |
| - Recurring work due to the poor quality of the job [7]|
| - Too many project being handled at the same time [5]  |
| - A long delay between SPK and project execution [7]   |
| - Poor relationship between owner-planner-and contractors [5] |
| - Lack of coordination among construction manager-planner-and contractors [5] |
| - There is a dispute on the project [7]                |
| - Project manager lacking competence [7]               |
| Project documents                                      |
| - Improper appointment of subcontractors and suppliers [7] |
| - Change in design happens frequently [7]              |
| - Incomplete contracts document [7]                    |
| Materials                                              |
| - Rising cost of materials [7]                         |
| - Lateness/lack of materials during project execution [7] |
| - Poor quality controls of the materials [7]           |
| - The wrong use of materials [7]                       |
| - The stealing of materials [7]                        |
| - The damage in materials [7]                          |
| - The production of the materials outside the project site [7] |
| - Errors in managing materials storage [8]             |
| Labour force                                           |
| - Lack of Labour force [7]                             |
| - High labour wages [9]                                |
| - Unskilled labour force [9]                           |
| - Improper placement of project personnel in the organizational structure [8] |
| Equipment                                              |
| - High equipment rental cost [7]                       |
| - High Prices for mobilizing / demobilizing equipment [7] |
| - Equipment maintenance cost did not go as planned [7] |
2.4. Data Collection
In this research, the targeted respondents were the contractors from subfield SI008 with K1, M1 and M2 qualifications. The population of this research was 62 contractors. By using Slovin equations, 54 contractors were selected as a sample of this research for a 5 percentile margin of error. Sampling technique that used in this research was purposive sampling techniques, which is a technique that purposefully taking out a sample from the population with certain considerations [10]. Its considerations are based on the registered contractors within LPJK company associations of Aceh in 2020 and have ever been involved in the installation of drinking water pipes in Banda Aceh between 2015-2020. Measurement of answer was done by using likert scale, where any answer from the contractors can be disclosed by means of assessment, as shown in table 2.

Table 2. Answer Categories [12]

| No | Qualifications         | Score |
|----|------------------------|-------|
| 1  | Very Influential       | 5     |
| 2  | Influential            | 4     |
| 3  | Moderately Influential | 3     |
| 4  | Low influential        | 2     |
| 5  | Very Low Influential   | 1     |

2.5. Data Processing
Data processing in this research was done after collecting all the questionnaires from all 54 sample respondents. This data processing includes both validity and reliability test. Then, analysis descriptive was conducted in order to get the most dominant mean value through ranking the average mean value using SPSS 24 software. To calculate the mean value, such formula can be used [11].

\[
\text{Me}(x) = \frac{\sum x_i}{n}
\]

Where:
- \( \text{Me}(x) \) = Mean (Average) x variable;
- \( n \) = Number of respondents;
- \( \sum \) = Sigma (jumlah);
- \( x_i \) = X score from i to n; and
- \( i \) = Respondents category Index (i = 1, 2, 3, ...)
- \( XI \) = Frequency of Answer “Very Influential”
3. Result and Discussion

Based on calculating the mean value from all indicators, then mean value recapitulation of each factors can be shown as summarized in table 3.

| Variable                        | Mean  | Rank |
|---------------------------------|-------|------|
| Cost estimation factor          | 4.417 | 1    |
| Execution and working relations factor | 4.243 | 4    |
| Project documents factor        | 3.958 | 10   |
| Materials factor                | 4.176 | 5    |
| Labour force factor             | 4.292 | 2    |
| Equipment factor                | 4.285 | 3    |
| Project fund factor             | 4.097 | 7    |
| Project execution factor        | 4.037 | 9    |
| Political economy policy factor | 4.074 | 8    |
| Environment factor              | 4.154 | 6    |

Overall, all the factors which caused cost overruns can be shown at picture 3.

The most dominant factor that caused cost overruns in drinking water distribution projects in Banda Aceh was because of cost estimation factor with mean value of 4,417. There were 4 indicators in the estimation factor within this research, including lack of data and information on the projects, not taking inflation and escalation into considerations, did not calculate the risk on project site and inaccuracy in estimating cost. In a previous study by Remi (2017), [5] the dominant factor which caused cost overruns in a project was determined by mode value from previous research result that resulted in four factors including, project fund, materials, labour force, and economic viability.

4. Conclusion

From the calculation of the mean value obtained ten factors that caused cost overruns in drinking water distribution projects in Banda Aceh, namely; Cost estimation has a value of 4,417, Labour force has a value of 4,292, Equipment has a value of 4,285, Execution and working relations has a value of 4,243, Materials has a value of 4,176, Environment has a value of 4,154, Project fund has a value of 4,097, Political economy policy has a value of 4,074, Project execution has a value of 4,037, Project documents has a value of 3,958.

The most dominant factor that caused cost overruns in drinking water distribution projects in Banda Aceh is because of cost estimation factor with mean value of 4,417. Based on this result, to minimize
the possibility of running into cost overruns of drinking water distribution projects in Banda Aceh, the contractor can set up an estimation cost plan perfectly by adding more information on future drinking water projects, taking into accounts the effects of inflation and escalation, supervising the risk of site projects and become more cautious in estimating the project cost.

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