Optimal Profitability Analysis for Contractors Regarding Variations in Payment Systems and Scheduling

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ABSTRACT

Construction projects often face higher risks than other types of projects, primarily due to potential delays from inaccurate scheduling and cash flow issues. Therefore, effective scheduling and payment systems are crucial for contractors to reduce risks and achieve optimal profitability. This study aims to identify optimal cash flow and profitability for contractors through the analysis of various payment systems and the utilization of float time. The methods used include cash flow analysis and feasibility analysis using NPV, BCR, and ROI methods. This research explores eight different payment and scheduling approaches to evaluate their impact on project profitability. The results show that cash flow across all alternatives remains positive without experiencing a shortage of funds and indicate that the contractor's optimal profitability is achieved with application of alternative 5, featuring 0\% float time and no advance payments. This alternative results in the highest profit, with an NPV of Rp 15,338,960,581, a BCR of 1.059, and an ROI of 5.90\%. From these results, it can be concluded that not utilizing float time leads to the most optimal profitability for the contractor. Additionally, it can be said that the scheduling plan implemented by the contractor for the Twin Tower project is well-structured. However, for the payment system, it is recommended to adopt a no-advance payment approach. It is hoped that this study will help contractors optimize their profits in the competitive construction industry.

Keywords: Profitability, Payment Systems, Scheduling, Cash Flow Analysis, Feasibility Analysis

Proyek konstruksi sering kali dihadapkan pada risiko yang lebih tinggi daripada jenis proyek lainnya, terutama disebabkan oleh potensi keterlambatan akibat penjadwalan yang tidak akurat dan masalah dalam arus kas. Oleh karena itu, analisis penjadwalan dan sistem pembayaran yang efektif sangat penting bagi kontraktor untuk mengurangi risiko serta mendapatkan profitabilitas optimal. Penelitian ini dilakukan dengan tujuan untuk mengidentifikasi aliran kas (cash flow) serta profitabilitas optimal bagi kontraktor melalui analisis berbagai sistem pembayaran dan pemanfaatan waktu tunda (float time). Metode yang digunakan mencakup analisis aliran kas dan analisis kelayakan dengan menggunakan metode NPV, BCR, dan ROI. Penelitian ini mengeksplorasi delapan variasi pendekatan pembayaran dan penjadwalan yang berbeda untuk mengevaluasi dampaknya terhadap profitabilitas proyek. Hasil penelitian menunjukkan bahwa aliran arus kas (cash flow) pada seluruh alternatif tetap positif dan tidak mengalami kekurangan dana serta menunjukkan bahwa profitabilitas optimal kontraktor dapat dicapai pada alternatif 5, dengan variasi waktu float time 0\% dan tanpa pembayaran muka. Alternatif tersebut menghasilkan profit tertinggi, dengan NPV sebesar Rp 15,338,960,581, BCR sebesar 1,059, dan ROI sebesar 5,90\%. Dari hasil tersebut dapat disimpulkan bahwa apabila tidak dilakukan pemanfaatan waktu tunda (float time), maka akan didapatkan profitabilitas paling optimal bagi kontraktor. Selain itu, dapat dikatakan bahwa rencana penjadwalan yang diterapkan oleh kontraktor pada proyek Twin Tower sudah tersusun dengan baik. Namun, untuk sistem pembayarannya disarankan untuk menerapkan pembayaran tanpa uang muka. Dengan ini diharapkan agar penelitian ini membantu kontraktor dalam mengoptimalkan keuntungannya dalam industri konstruksi yang kompetitif.

Kata Kunci: Profitabilitas, Sistem Pembayaran, Penjadwalan, Analisis Arus Kas, Analisis Kelayakan
1. **INTRODUCTION**

A construction project is a series of activities aimed at achieving development according to the established schedule, budget, and quality standards (Sugiyanto, 2020). Compared to other types of projects, construction projects are known to have a higher level of uncertainty and risk due to several factors (Xie & Yang, 2021). Factors such as design complexity and frequent changes, uncertainty in labor and fund availability, and suboptimal contractual relationships between project owners, consultants, and contractors contribute to increased uncertainty. Therefore, it is crucial for contractors to identify, predict, and manage potential risks in a project to ensure its smooth execution (Huqban et al., 2020).

In projects, there are numerous risks that might occur. Delays in activity execution are a common risk. According to Tolangi et al. (2012), this risk can result in schedule changes and significantly impact the overall project cost. Such delays directly oppose the contractor's goal of achieving optimal profitability. One effective way to address delays or changes in project execution is by utilizing float time. Float time allows for the postponement of activities without affecting the overall project completion time (Putri et al., 2023).

Besides delays, cost risks can also arise from cash flow disruptions due to the contractor's lack of skills in managing cash flow (Suniarta et al., 2023). This can lead to delays due to the unavailability of funds to continue activities, forcing the project to halt (Natalia et al., 2017). Contractor profitability stems from the difference between the cost estimate and the project cost budget. However, many construction service companies face liquidity issues due to a lack of understanding in financial management (Gundes et al., 2019). Therefore, contractors need to recognize that with limited financial resources, effective resource management is essential to achieve maximum profit or profitability.

In summary, managing risks such as delays and cash flow disruptions, and understanding the financial aspects of a project, are key to ensuring the successful completion and profitability of construction projects. Proper utilization of float time, and good financial management practices are crucial for achieving the goals.

2. **LITERATURE REVIEW**

A. **Project Scheduling**

Project scheduling is crucial for ensuring a project progresses as planned. It organizes activities from initiation to completion, considering progress, duration, and overall advancement. Accurate scheduling mitigates potential delays and ensures smooth execution. Time performance standards are set by detailing project stages, durations, and predecessors.

This research uses Microsoft Project for scheduling, employing network planning methods like the critical path method (CPM) and the precedence diagram method (PDM). These methods identify the critical path and task dependencies, and help determine float time, which is a key focus of this study.

1. **CPM (Critical Path Method)**

The critical path method or critical path analysis, is a project network analysis technique that calculates the total duration of project. The critical path comprises a series of activities that determine the shortest possible project
completion time (Siregar & Ardiansyah, 2022). This path represents the longest sequence of activities in the project network and is highly sensitive to delays. If a critical activity is delayed by even one day, the entire project will be delayed, regardless of whether other activities are on schedule (Safitri et al., 2019).

2. **PDM (Precedence Diagram Method)**

The precedence diagram method (PDM) is a project scheduling technique that helps to easily understand the relationships between project activities. The PDM network principle involves dependencies among activities based on four fundamental relationships:

a. **Finish to Start (FS)**
   Where an activity cannot start until the preceding activity finishes

b. **Start to Start (SS)**
   Where an activity cannot start until the preceding activity starts

c. **Finish to Finish (FF)**
   Where an activity cannot finish until the preceding activity finishes

d. **Start to Finish (SF)**
   Where an activity cannot finish until the preceding activity starts.

B. **Execution Budget Plan**

The construction cost budget is an estimate of the costs required to execute a project on-site. By accurately calculating work volume, material requirements, detailed prices, and labor costs for each unit of work. Additionally, the costs of necessary equipment, including procurement and operational expenses, must be considered. The formula for calculating the execution budget plan is as follows:

\[
\text{Execution Budget Plan} = \text{Project Cost} - \text{Profit Margin} = \text{Project Cost} - (10\% \times \text{Project Cost}) = 0.90 \times \text{Project Cost} \quad (1)
\]

In this formula, profit is 10% of the project cost. Subtracting this from the project cost yields the execution budget plan, which is 90% of the project cost.

C. **Task Weight**

Task weight or work weight represents the proportion of work completed relative to the total project workload. Assigning a weight to each task highlights its contribution to overall progress. Understanding task weight helps identify each task's impact on the total project completion.

\[
\text{Task Weight} = \frac{\sum_{i=0}^{\text{est}} \text{Effort for Task } i}{\sum_{i=0}^{\text{est}} \text{Effort for All Task}} \times 100 \quad (2)
\]

D. **Cash Flow**

Cash flow is a critical aspect of running a business. It refers to the movement of cash in and out of a company over a specific period. A solid understanding of cash flow is essential as it reflects the financial health of a
company. A positive cash flow indicates that the company is generating more money than it is spending. Conversely, a negative cash flow suggests that the company is spending more money than it is earning, which can lead to financial troubles. Effective cash flow management involves careful monitoring of inflows and outflows, as well as strategic planning to ensure smooth operations and sustainable business growth. Thus, understanding and effectively managing cash flow are key to ensuring financial success.

E. Feasibility Analysis

Feasibility analysis is essential for assessing the viability of a project before its initiation. It assesses technical, economic, legal, and operational factors for project viability. In construction projects, feasibility analysis ensures that proposed developments meet objectives. In this research, the methods used are BCR, NPV, and ROI, with the following formulas.

1. Net Present Value (NPV)

Net present value is essential for assessing the profitability and feasibility of investments. It quantifies the disparity between the present value of net cash flows throughout the project's lifespan. This calculation involves comparing the current value of future cash inflows, discounted to present value using a set discount rate, with the initial outlay. According to Tiwari and Sahota (2018), the formula and evaluation criteria for NPV are as follows.

\[
NPV = \sum_{t=0}^{n} \frac{(B_t - C_t)}{(1+i)^t}
\]

Where:
- \(n\) = the lifespan of the project (monthly or yearly)
- \(B_t\) = the revenue generated in the \(t\)-year
- \(C_t\) = denotes the production in the \(t\)-year
- \(i\) = discount rate

Evaluation Criteria:
- If NPV > 0, the investment is profitable or feasible
- If NPV = 0, the present value of benefits equals the present value of costs
- If NPV < 0, the investment is not profitable or not feasible

2. Benefit-Cost Ratio (BCR)

The benefit-cost ratio (BCR) is a key financial metric for assessing the profitability and viability of investment projects. This ratio compares the present value of a project's benefits to the present value of its costs. BCR analysis aids in resource allocation and risk management to maximize returns and minimize losses. The BCR formula is expressed as the ratio of the present worth of benefits to the present worth of costs.

\[
BCR = \frac{\text{Present Worth Of Benefit}}{\text{Present Worth Of Cost}} = \frac{\sum_{t=0}^{n} (B_t)}{\sum_{t=0}^{n} (C_t)}
\]
**Evaluation Criteria:**
If BCR > 1, the investment generates profits or is feasible.
If BCR < 1, the investment does not generate profits or is not feasible

3. **Return on Investment (ROI)**

Return on investment (ROI) is a pivotal metric measuring investment efficiency by comparing net project profit to investment costs. This financial ratio evaluates the profitability of ventures by assessing the returns relative to the capital invested. A higher ROI signifies greater profitability, while a lower ROI suggests less favorable returns. This analysis aids decision-makers in evaluating risks and rewards, guiding resource allocation and strategic planning for sustainable growth. According to Botchkarev and Andru (2011), the formula for ROI are as follows.

\[
\text{ROI} = \frac{\sum \text{Financial Return} - \sum \text{Cost}}{\sum \text{Cost}}
\]  

(5)

By analyzing these three methods, contractors can make more informed decisions about investment projects and optimize development strategies to achieve long-term financial goals. If all three methods deem the project feasible, then the project can proceed or be implemented.

3. **RESEARCH METHODOLOGY**

The research was conducted at the Twin Tower building project of UPN "Veteran" East Java over five months, from January 2024 to May 2024. The project began with proposal preparation and concluded with the thesis defense. The primary objective was to analyze cash flow and project feasibility, ultimately identifying the most optimal alternatives for the contractor.

This study uses a quantitative research approach. The data used in this research is secondary data obtained from relevant parties involved in the project implementation, specifically the contractor. The research includes a flowchart that delineates the sequential steps to be followed. Below is the depicted diagram.
For further clarification regarding the above flowchart, it's essential to understand the meticulous steps involved in any research endeavor to achieve desired outcomes. Here are the outlined steps relevant to this research:

1. **Preparation**
   Reviewing existing literature to define objectives and determine methodologies.

2. **Data Collection**
   This data collection process entails gathering data by browsing official websites and making direct requests to relevant parties.

3. **Creating a Detailed Schedule Plan**
   Identifies project activities and determines their sequence and duration.

4. **Determining Float Time Variations**
   After creating the schedule plan, implementation float time variations of 0%, 35%, 65%, 100% for each activity are determined to measure the project schedule's flexibility in handling potential delays.

5. **Project Cost Evaluation**
   Analyzes material costs, labor, and other expenses involved.

6. **Calculating Monthly Execution Budget Plan**
   Tracks monthly budget allocations to ensure effective financial management by utilizing the microsoft project application.

7. **Cash Flow Calculation**
   Examines cash inflows and outflows to assess the project's financial status.

8. **Conducting Feasibility Analysis**
   The feasibility analysis involves utilizing methods such as NPV, BCR, and
ROI to evaluate project profitability.

By carefully adhering to each detailed step, thoroughly scrutinizing the research process, and systematically applying the methodologies described, significant and beneficial results are anticipated from this research endeavor.

In this study, eight variations of payment systems and scheduling will be explored. Subsequently, the optimal profitability variation will be determined.

Table 3.1 Payment systems and scheduling variations

<table>
<thead>
<tr>
<th>Num</th>
<th>Float Time Variation</th>
<th>Advance Payment</th>
<th>No Advance Payment (Equity 60% + Debt 40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Float time 0%</td>
<td>Alternative 1</td>
<td>Alternative 5</td>
</tr>
<tr>
<td>2</td>
<td>Float time 35%</td>
<td>Alternative 2</td>
<td>Alternative 6</td>
</tr>
<tr>
<td>3</td>
<td>Float time 65%</td>
<td>Alternative 3</td>
<td>Alternative 7</td>
</tr>
<tr>
<td>4</td>
<td>Float time 100%</td>
<td>Alternative 4</td>
<td>Alternative 8</td>
</tr>
</tbody>
</table>

4. RESEARCH RESULTS

A. Project Scheduling

In this stage, scheduling is performed using the microsoft project application. The process begins by aligning the schedule with the previously formulated project plan. Once the critical path, non-critical path, and float time are determined, the subsequent step involves creating schedules based on specified float time variations, namely 0%, 35%, 65%, and 100%. This method facilitates the evaluation of how changes in float time impact the project schedule and provides insights into their influence on overall project execution. By scheduling according to different float time variations, the project team can discern the most effective strategies for efficiently managing time during project implementation.

B. Execution Budget Plan

After finalizing the scheduling according to predefined float time variations of 0%, 35%, 65%, and 100%, the next stage entails performing cash flow analysis using the microsoft project to ascertain the execution budget plan for each month. Formula (1) is used to calculate the execution budget plan as follows:

\[ \text{Execution Budget Plan} = \text{Project Cost} - \text{Profit Margin} \]
\[ = \text{Rp} \ 217,000,000,000 - (10\% \times \text{Rp} \ 217,000,000,000) \]
\[ = \text{Rp} \ 195,300,000,000 \]

By employing the specified calculation, a thorough comprehension understanding of the financial needs for each month is guaranteed, thereby enabling efficient budget control during project implementation phase. Utilizing this formula alongside cash flow analysis conducted via microsoft project yields a summary of the execution budget plan for each month, as depicted in Table 4.1

Table 4.1 Monthly execution budget plan

<table>
<thead>
<tr>
<th>Month</th>
<th>Float Time Variations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>Rp 2,413,788.530</td>
</tr>
</tbody>
</table>
weight and cumulative progress per month will be outlined in actions to ensure project milestones are efficiently met. The overview of work task and determinin

<table>
<thead>
<tr>
<th>Month</th>
<th>Float Time Variations</th>
<th>0%</th>
<th>35%</th>
<th>65%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Rp 5.140.184.806</td>
<td>Rp 5.140.184.806</td>
<td>Rp 4.984.254.262</td>
<td>Rp 4.984.254.262</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Rp 4.909.788.000</td>
<td>Rp 4.909.788.000</td>
<td>Rp 4.909.788.000</td>
<td>Rp 4.909.788.000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Rp 195.300.000.000</td>
<td>Rp 195.300.000.000</td>
<td>Rp 195.300.000.000</td>
<td>Rp 195.300.000.000</td>
<td></td>
</tr>
</tbody>
</table>

C. Task Weight

After establishing the execution budget plan for each month, the next step is to calculate the task weights. This involves estimating costs for each individual task and determining the total cost for all tasks combined. Formula (2) is utilized to calculate the execution budget plan.

Utilizing this formula, task weight is calculated for each month. By analyzing the task weight and cumulative progress monthly, contractors can identify any deviations from the planned schedule and take necessary corrective actions to ensure project milestones are efficiently met. The overview of work weight and cumulative progress per month will be outlined in Table 4.2

### Table 4.2 Recapitulation of task weight and cumulative progress for each month

<table>
<thead>
<tr>
<th>Month</th>
<th>Float Time Variations 0%</th>
<th>Float Time Variations 35%</th>
<th>Float Time Variations 65%</th>
<th>Float Time Variations 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.016</td>
<td>0.016</td>
<td>0.016</td>
<td>0.016</td>
</tr>
<tr>
<td>2</td>
<td>1.236</td>
<td>1.252</td>
<td>1.252</td>
<td>1.252</td>
</tr>
<tr>
<td>3</td>
<td>1.862</td>
<td>3.114</td>
<td>3.114</td>
<td>3.114</td>
</tr>
<tr>
<td>4</td>
<td>8.048</td>
<td>11.162</td>
<td>8.149</td>
<td>3.385</td>
</tr>
<tr>
<td>6</td>
<td>11.595</td>
<td>37.731</td>
<td>36.458</td>
<td>33.762</td>
</tr>
<tr>
<td>7</td>
<td>6.641</td>
<td>44.373</td>
<td>43.401</td>
<td>42.618</td>
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<tr>
<td>8</td>
<td>5.956</td>
<td>50.329</td>
<td>49.962</td>
<td>49.648</td>
</tr>
<tr>
<td>9</td>
<td>4.564</td>
<td>54.893</td>
<td>54.462</td>
<td>54.242</td>
</tr>
<tr>
<td>10</td>
<td>5.226</td>
<td>60.119</td>
<td>59.684</td>
<td>59.422</td>
</tr>
<tr>
<td>11</td>
<td>4.984</td>
<td>65.103</td>
<td>64.656</td>
<td>64.389</td>
</tr>
</tbody>
</table>
## Cash Flow Analysis

Cash flow analysis is crucial for the financial management of any project, ensuring its viability. In this research, cash flow analysis investigates payment systems and float time variations, including scenarios with and without advance payments at implementation of 0% float time. This analysis evaluates financial dynamics, offering insights for decision-making throughout the project lifecycle. By examining cash flows, contractors can anticipate financial challenges and make informed decisions to sustain project financial health. Examination aids in identifying optimal financial strategies for project success, enhancing better management and sustainability.

### 1. With Advance Payments

With advance payments, a project receives funds upfront, which significantly improves cash flow. This reduces financial strain on contractors by providing immediate capital for expenses such as materials and labor and ensuring funds are available when needed. It also enhances the contractor's ability to negotiate with suppliers and subcontractors, thereby maintaining the project's financial health and operational efficiency. To enhance clarity on cash inflows and outflows, the following cash flow diagram will be presented.

<table>
<thead>
<tr>
<th>Month</th>
<th>Float Time 0%</th>
<th>Float Time 35%</th>
<th>Float Time 65%</th>
<th>Float Time 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Task Weight</td>
<td>Progres</td>
<td>Task Weight Progres</td>
<td>Task Weight Progres</td>
</tr>
<tr>
<td>12</td>
<td>3,571</td>
<td>68,673</td>
<td>68,673</td>
<td>68,673</td>
</tr>
<tr>
<td>13</td>
<td>2,218</td>
<td>70,891</td>
<td>70,891</td>
<td>70,891</td>
</tr>
<tr>
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<td>2,122</td>
<td>73,013</td>
<td>72,756</td>
<td>72,756</td>
</tr>
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<td>2,323</td>
<td>75,336</td>
<td>75,052</td>
<td>74,821</td>
</tr>
<tr>
<td>16</td>
<td>2,248</td>
<td>77,584</td>
<td>77,300</td>
<td>77,068</td>
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<tr>
<td>17</td>
<td>2,542</td>
<td>80,126</td>
<td>79,732</td>
<td>79,411</td>
</tr>
<tr>
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<td>2,514</td>
<td>85,722</td>
<td>84,878</td>
<td>84,557</td>
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<td>2,541</td>
<td>87,812</td>
<td>87,419</td>
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<td>21</td>
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<td>1,662</td>
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<td>25</td>
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<td>98,540</td>
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</tr>
<tr>
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<td>99,546</td>
<td>99,546</td>
<td>99,546</td>
</tr>
<tr>
<td>28</td>
<td>0.454</td>
<td>100</td>
<td>0.454</td>
<td>100</td>
</tr>
</tbody>
</table>
Figure 4.1 Cash flow diagram for alternative 1 (Advance Payment and 0% Float Time)

The diagram illustrates cash inflows and outflows throughout the project, offering a clear overview of its financial status at different stages. To simplify the presentation of monthly cash flow analysis results, they will be shown in Table 4.3

Table 4.3 Cash flow analysis results of alternative 1
The table shows a consistently positive cash balance from month 0 - 29, indicating a healthy financial status throughout the project duration. This reflects effective management of cash inflows and outflows, ensuring that the funds are available to cover expenses and meet financial obligations. With this stable financial foundation, the project can proceed to the feasibility analysis phase.

2. Without Advance Payments

Without advance payments, projects depend solely on progress or post-completion payments, which can strain contractors' cash flow. Covering initial expenses from their own financing may lead to stress and delays if funds are insufficient. This situation also reduces negotiating leverage with suppliers, potentially increasing costs. Managing cash flow under these conditions becomes more challenging, requiring careful financial planning to keep the project on track and within budget. To provide a clearer understanding of cash inflows and outflows, the following cash flow diagram will be presented.

![Figure 4.2 Cash flow diagram for alternative 5 (No Advance Payment and 0% Float Time)](image)

The diagram illustrates cash inflows and outflows throughout the project, offering a clear overview of its financial status at different stages. To simplify the presentation of monthly cash flow analysis results, they will be shown in Table 4.4

### Table 4.4 Cash flow analysis results of alternative 5

<table>
<thead>
<tr>
<th>Month</th>
<th>Task Weights</th>
<th>Cumulative Progress</th>
<th>Invoice</th>
<th>Net Termyn Payment</th>
<th>Return Of Guarantees</th>
<th>Performance Guarantee</th>
<th>Maintenance Guarantee</th>
<th>Capital Loan</th>
<th>Cash In Total</th>
<th>Net Cost Budget</th>
<th>Guarantees Payment</th>
<th>Loan Repayment</th>
<th>Cash Out Total</th>
<th>Ending Cash Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.001</td>
<td>0.016</td>
<td>0.226</td>
<td>0.622</td>
<td>0.606</td>
<td>11.205</td>
<td>11.575</td>
<td>6,641</td>
<td>5,956</td>
<td>4,564</td>
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<td>0.606</td>
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<td>11.575</td>
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<td>5,956</td>
<td>4,564</td>
<td>35,334</td>
<td>0</td>
<td>21,790</td>
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<tr>
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<td>0.001</td>
<td>0.016</td>
<td>0.226</td>
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<td>8</td>
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<td>0.622</td>
<td>0.606</td>
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<td>4,564</td>
<td>35,334</td>
<td>0</td>
<td>21,790</td>
<td>6,667</td>
</tr>
</tbody>
</table>
The table shows a consistently positive cash balance from month 0 - 29, indicating a healthy financial status throughout the project duration. This ensures there are sufficient funds available to cover expenses and meet financial obligations. With this, the project can proceed to the feasibility analysis phase.

E. Feasibility Analysis

After analyzing cash flow and assessing project feasibility, the next step is to explore alternative options for maximizing profitability. This involves selecting alternatives based on evaluation results using methods like Net Present Value (NPV), Benefit-Cost Ratio (BCR), and Return on Investment (ROI). These methods offer valuable insights into the financial viability. For instance, NPV compares cash inflows and outflows over the project's lifespan, while BCR measures investment efficiency by comparing net profit to investment costs. An example feasibility analysis for alternatives with and without an advance payment system at a 0% float time variation will be provided to illustrate this process.

1. With Advance Payments

In the analysis with advance payments, NPV, BCR, and ROI values are calculated to assess the project's financial viability. These metrics offer essential insights into the profitability, cost-benefit ratio, and investment efficiency.

A. Net Present Value (NPV)

\[
NPV = \sum_{t=0}^{n} \frac{(B_t-C_t)}{(1+i)^t}
\]

\[
= Rp \ 13,290,456,816 > 1 \text{ (Feasible)}
\]

E. Feasibility Criteria

If NPV > 0, the investment is profitable or feasible.
If NPV = 0, the present value of benefits equals the present value of costs.
If NPV < 0, the investment is not profitable or not feasible.
B. Benefit Cost Rasio (BCR)

\[
BCR = \frac{\sum_{t=0}^{n} (B_t) \times (1 + i)^{-t}}{\sum_{t=0}^{n} (C_O) \times (1 + i)^{-t}}
\]

\[
= \frac{\text{Present Worth Of Benefit}}{\text{Present Worth Of Cost}}
\]

\[
= \frac{\text{Rp 286.079.764.678}}{\text{Rp 272.789.307.863}}
\]

\[
= 1.049 > 1 \text{ (Feasible)}
\]

**Evaluation Criteria**

If BCR > 1, the investment generates profits or is feasible.
If BCR < 1, the investment does not generate profits or is not feasible

C. Return On Investment (ROI)

\[
ROI = \frac{\sum \text{Financial Return} - \sum \text{Cost}}{\sum \text{Cost}} \times 100
\]

\[
= \frac{\text{Rp 286.079.764.678} - \text{Rp 272.789.307.863}}{\text{Rp 272.789.307.863}} \times 100
\]

\[
= 4.87\% \text{ (Feasible)}
\]

For a clearer presentation of the project evaluation results for each month and to facilitate feasibility analysis, they will be illustrated in the table below:

<table>
<thead>
<tr>
<th>Table 4.5 Project evaluation of alternative 1</th>
</tr>
</thead>
</table>

The feasibility analysis for alternative 1 with advance payment and a 0% float time shows that the project is viable based on criteria NPV, BCR, and ROI.

2. Without Advance Payments

In the analysis without advance payments, NPV, BCR, and ROI values are...
calculated to assess the project's financial viability. These metrics offer essential insights into the profitability, cost-benefit ratio, and investment efficiency.

A. Net Present Value (NPV)

\[
NPV = \sum_{t=0}^{n} \frac{(B_t-C_t)}{(1+i)^t}
\]

\[
= Rp 15.338.960.581 > 1 \text{ (Feasible)}
\]

**Evaluation Criteria**

If NPV > 0, the investment is profitable or feasible.
If NPV = 0, the present value of benefits equals the present value of costs
If NPV < 0, the investment is not profitable or not feasible.

B. Benefit Cost Ratio (BCR)

\[
BCR = \frac{\sum_{t=0}^{n} \frac{(B_t)}{(1+i)^t}}{\sum_{t=0}^{n} \frac{(C_t)}{(1+i)^t}}
\]

\[
= \frac{\text{Present Worth Of Benefit}}{\text{Present Worth Of Cost}}
\]

\[
= \text{Rp 274.236.663.814} \quad \text{ Rp 259.318.613.414}
\]

= 1.059 > 1 \text{ (Feasible)}

**Evaluation Criteria**

If BCR > 1, the investment generates profits or is feasible.
If BCR < 1, the investment does not generate profits or is not feasible.

C. Return On Investment (ROI)

\[
ROI = \frac{\sum \text{Financial Return} - \sum \text{Cost}}{\sum \text{Cost}} \times 100
\]

\[
= \frac{\text{Rp 274.236.663.814} - \text{ Rp 259.318.613.414}}{\text{ Rp 259.318.613.414}} \times 100
\]

= 5.90% \text{ (Feasible)}

For a clearer presentation of the project evaluation results for each month and to facilitate feasibility analysis, they will be illustrated in the table below:

**Table 4.6 Project evaluation alternative 5**
The feasibility analysis for alternative 5 without advance payment and a 0% float time shows that the project is viable based on criteria NPV, BCR, and ROI.

Following the demonstrated method, feasibility analysis will be conducted for all eight alternatives. This comprehensive evaluation will assess various payment systems and scheduling strategies. The results will be presented in Table 4.7 for clear comparative analysis, facilitating informed decision-making.

**Table 4.7 Recapitulation of feasibility analysis results**

<table>
<thead>
<tr>
<th>Variation</th>
<th>NPV</th>
<th>BCR</th>
<th>ROI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance Payment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Float Time 0%</td>
<td>Alternatif 1</td>
<td>Rp 13,290,456,816</td>
<td>1.049</td>
</tr>
<tr>
<td>Float Time 35%</td>
<td>Alternatif 2</td>
<td>Rp 13,014,655,602</td>
<td>1.048</td>
</tr>
<tr>
<td>Float Time 65%</td>
<td>Alternatif 3</td>
<td>Rp 12,932,514,665</td>
<td>1.047</td>
</tr>
<tr>
<td>Float Time 100%</td>
<td>Alternatif 4</td>
<td>Rp 13,154,738,496</td>
<td>1.048</td>
</tr>
<tr>
<td>No Advance Payment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Float Time 0%</td>
<td>Alternatif 5</td>
<td>Rp 15,338,960,581</td>
<td>1.059</td>
</tr>
<tr>
<td>Float Time 35%</td>
<td>Alternatif 6</td>
<td>Rp 15,024,963,627</td>
<td>1.058</td>
</tr>
<tr>
<td>Float Time 65%</td>
<td>Alternatif 7</td>
<td>Rp 14,918,050,400</td>
<td>1.058</td>
</tr>
<tr>
<td>Float Time 100%</td>
<td>Alternatif 8</td>
<td>Rp 15,140,274,232</td>
<td>1.058</td>
</tr>
</tbody>
</table>

To facilitate the conclusion from Table 4.7, diagrams comparing Net Present Value (NPV), Benefit Cost Ratio (BCR), and Return on Investment (ROI) against payment systems and scheduling were created. The following diagrams show the trends of NPV, BCR, and ROI for two payment methods, namely advance payments and no advance payments, with float time variations of 0%, 35%, 65%, and 100%.

**Figure 4.3 Net Present Value (NPV) on Payment System and Scheduling (Float Time)**
Figure 4.3 depicts the NPV comparison between two payment methods, advance payments and no advance payments, across varying float times of 0%, 35%, 65%, and 100%. The x-axis indicates the percentage of float time, while the y-axis represents NPV in Indonesian Rupiah (Rp). The blue line, representing advance payments, shows a lower NPV, whereas the orange line, representing no advance payments, maintains a higher NPV. Notably, no advance payments at 0% float time achieve the highest NPV, indicating the optimal profitability.

![Figure 4.3 NPV Comparison](image)

Figure 4.4 Benefit Cost Ratio (BCR) on Payment System and Scheduling (Float Time)

Figure 4.4 illustrates the BCR trends for two payment methods, advance payments and no advance payments, as the float time varies from 0%, 35%, 65%, to 100%. The x-axis shows the percentage of float time, and the y-axis displays the BCR. The blue line, representing advance payments, demonstrates a lower BCR, while the orange line, representing no advance payments, shows a higher BCR. Notably, the highest BCR is observed with no advance payments at 0% float time, indicating this is the most beneficial scenario.

![Figure 4.4 BCR Comparison](image)

Figure 4.5 Return On Investment (ROI) on Payment System and Scheduling (Float Time)

Figure 4.5 presents the ROI comparison for advance payments and no advance payments with float times at 0%, 35%, 65%, and 100%. The x-axis denotes the percentage of float time, while the y-axis indicates the ROI. The blue line (Advance Payments) and the orange line (No Advance Payments) reveal the ROI trends under different float time scenarios. Notably, no advance payments at 0%
float time exhibit the highest ROI, highlighting the condition for maximizing returns.

5. CONCLUSION

After conducting a cash flow analysis and feasibility study utilizing float time with both advance payment and non-advance payment funding systems, the following conclusions can be drawn from the research:

1. The optimal profitability for the contractor is achieved in alternative 5, where the float time is 0% with no advance payment, resulting in an NPV of Rp 15,338,960,581, a BCR of 1.059, and an ROI of 5.90%. This alternative shows that the cash flow remains consistently positive without any funding shortages, indicating a healthy financial condition. It also shows that avoiding float time utilization results in optimal profitability for the contractor.

6. SUGGESTIONS

Based on the analysis conducted, to improve the quality of future research outcomes, several recommendations can be proposed:

1. Further research is needed to analyze the feasibility and profitability of construction considering the escalation of the dollar exchange rate.
2. Further research is needed to analyze the feasibility and profitability of construction by considering the comparison of using materials with a higher percentage of local content.

DAFTAR PUSTAKA


