VALUE ENGINEERING IMPLEMENTATION IN THE RIVER SENTIONG NORMALIZATION PROJECT, JAKARTA CENTRAL

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VALUE ENGINEERING IMPLEMENTATION IN THE RIVER SENTIONG NORMALIZATION PROJECT, JAKARTA CENTRAL

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Abstract

In Central Jakarta, work to normalize times every year is carried out but the available budget is insufficient to accommodate all proposals for normalization every year. This research aims to optimize the use of the budget in public works infrastructure in Central Jakarta through the application of the value engineering (VE) method. The focus is on the Sentiong River Normalization Project by finding the best creative ideas using VE. The Value Engineering method consists of seven stages, including function analysis, evaluation, and recommendations. Primary data was obtained through interviews, while secondary data was in the form of Budget Plans and literature studies. The results showed that by replacing the previous design using concrete sheet piles, it was possible to achieve a cost savings of 15.61% in a 50 year construction period.

Keywords: *Value Engineering, Pile,River, Central Jakarta.*

INTRODUCTION

Jakarta, the capital of Indonesia, faces significant challenges related to its river infrastructure due to rapid urbanization, population growth, and inadequate water management systems. One of the main rivers in Jakarta is Kali Sentiong, which crosses the Central Jakarta area. Over time, Sentiong River experienced problems such as flooding, erosion, and pollution, which threatened the surrounding community and infrastructure. To address these challenges and improve the resilience of the river system, the Sentiong River normalization project in Central Jakarta will be implemented. This normalization project aims to increase river capacity, control water flow, and reduce flood risk. However, like many other large-scale infrastructure projects, normalization of Kali Sentiong faces various complexities, including cost optimization, technical constraints, and the need for sustainable solutions. Value Engineering implementation is emerging as a potential methodology to effectively address these challenges. Value Engineering is a systematic approach that focuses on maximizing the value of a project by optimizing its cost, quality, and functionality. By applying Value Engineering principles, project teams can identify alternative-innovative, optimize design options, and improve project performance with cost efficiency in mind.

This research aims to obtain optimal design and material selection that meets the output criteria of the Sentiong River normalization project by applying the Value Engineering method. Thus, this research can contribute to improving the efficiency of the Sentiong River normalization project and improving the quality and sustainability of river infrastructure in Central Jakarta. The limitations of this research will include the scope of the Sentiong River normalization project in Central Jakarta in 2023 in accordance with the Regulation of the Minister of Public Works of the Republic of Indonesia Number 12 / PRT /

M / 2014 concerning the Implementation of Urban Drainage Systems and Regulation of the Governor of the Special Capital Region of Jakarta Number 27 of 2019 concerning Amendments to Governor Regulation Number 161 of 2017 concerning Accounting Policy. The research will consider technical, economic, and environmental aspects relevant to the project. The research methods used are literature studies to study relevant Value Engineering theories and practices, field data analysis, and interviews with related experts and practitioners. Through the combination of these methods, this research will provide a comprehensive understanding of the implementation of Value Engineering in the Kali Sentiong normalization project.

RESEARCH METHODS

The object of this study uses the Value Engineering method for Normalization of the Sentiong River with the work items of River Stone Pile Structures, foundation work, earthworks and excavation material transportation, measurement and installation of bow planks, procurement of worker bunks, mobilization & demobilization, procurement of safety, health and work equipment and project nameplates.

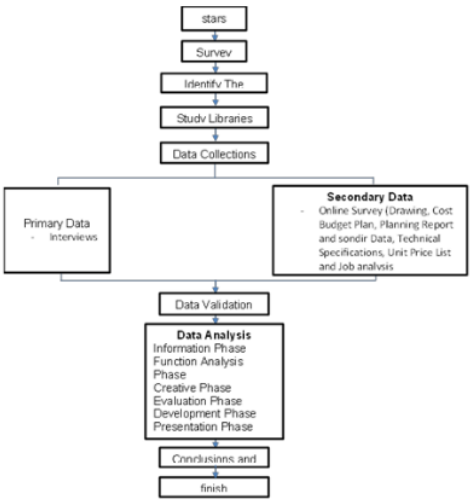
Research data

This research data includes:

1. Primary data with data collection techniques through direct interviews with related parties such as contractors, owners and consultants.
2. Secondary data is obtained from the Budget Plan (RAB) and other references. The data for this research were obtained from the results of a planning consultant's study in the form of: (i) Plan Drawings (ii) Budget Plans (iii) Planning Reports including sondir data and structural calculations (iv) Specifications used (v) List of Unit Prices and Job Analysis.

The data analysis technique includes seven stages, namely (i)information stage, (ii) function analysis stage, (iii) creative stage, (iv) evaluation stage, (v) development stage, (vi) presentation stage and (vii) recommendation stage.

Research Stages.



RESULTS AND DISCUSSION

Sentiong River Normalization Project, Central Jakarta, the length of the work is 839 meters with a planning design from a planning consultant in the form of stone plaster. The construction of sheet piles is expected to reduce the risk of natural disasters such as landslides on rivers that occur during the rainy season. The condition of the plaster on the Sentiong River is currently damaged, so it is necessary to rebuild the plaster in the river. The budget plan for the Sentiong River Normalization Project in Central Jakarta is IDR. 14.2 billion

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Table 1. Budget Plan for the Sentiong River Normalization Project, Central Jakarta

No	Work item	Work Weight Percentage
1	Pile and Foundation Work - River Stone Sheet Piling Structure Work - Foundation work - Earthworks - Excavated Transportation	97.81%
2	Bowplank Measurement and Installation	1.33%
3	Procurement of Workers' Beds (4 x 5 m)	0.48%
4	Mobilization & Demobilization	0.24%
5	Procurement of Safety, Health and Work Equipment (K3)	0.14%
6	Project Nameplate	0.01%
	Total Project Cost	Rp. 14.2 billion

Cost Model

Based on the cost model, it can be sorted from the highest cost to the lowest cost in order to make it easier to find out which work has most affected the Central Jakarta Sentiong River Normalization Project. Based on the Pareto Distribution Law above, it shows that sheet pile and foundation work is a high-value work item with a weight of 97.81%. Pile and foundation work includes the work of river rock sheet pile structures, foundation work, earthworks and transportation of excavated materials, to become one unit because if there is a change in the plaster structure work it will affect other work, such as foundations, sheet pile and earth excavation.

Based on table 2. Pile and Foundation work has the highest work weight in the Central Jakarta Sentiong River Normalization project which produces the highest value that can be carried out by Value Engineering.

Table 2. Pareto Distribution Law Calculation Table

NO	WORK ITEMS	COST	CUMULATIVE COST	PERCENTAGE OF CUMULATIVE WORK ITEMS (%)	CUMULATIVE COST PROCENTAGE (%)
1	Piling and Foundation Work	Rp 13.948.124.731,37	Rp 13.948.124.731,37	97,81%	97,81%
	River stone plaster structure work				
	Foundation work				
	Earthworks				
	Transport of Excavation				
2	Measurement and Installation of Bowplank	Rp 189.614.000,00	Rp 14.137.738.731,37	1,33%	99,14%
3	Procurement of Workers' Beds (4 x 5 m)	Rp 67.840.000,00	Rp 14.205.578.731,37	0,48%	99,61%
4	Mobilization & Demobilization	Rp 34.500.000,00	Rp 14.240.078.731,37	0,24%	99,85%
5	Procurement of Safety, Health and Work Equipment	Rp 19.372.000,00	Rp 14.259.450.731,37	0,14%	99,99%
6	Project Nameplate	Rp 1.396.000,00	Rp 14.260.846.731,37	0,01%	100,00%

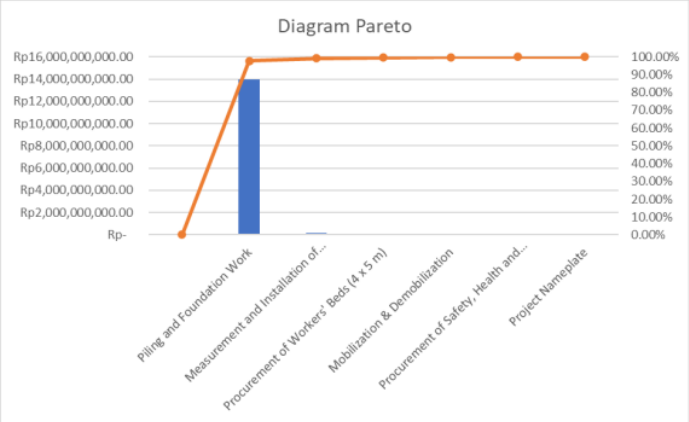
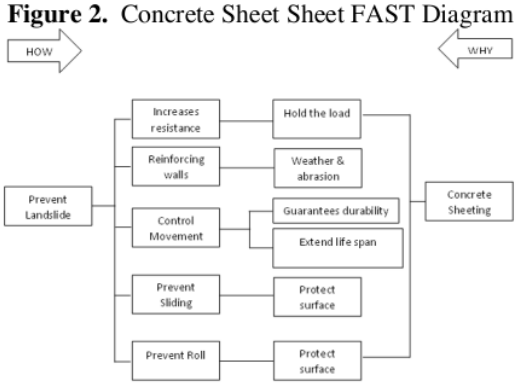


Figure 1. Law of the Pareto Distribution Diagram

FAST chart

After doing the Pareto Distribution Law Analysis, then it is described in the FAST Diagram on the work item to determine the accuracy of the function of the work item to be carried out by Value Engineering.

Figure 2. Concrete Sheet Sheet FAST Diagram



Function Analysis

At this stage the identification of functions consisting of active verbs and nouns will be carried out in the work items with the highest scores, namely sheet pile and foundation work as follows:

Table 3. Functional Analysis

INFORMATION STAGE **Function Analysis**						
Project	: Normalization of the Sentiong River, Central Jakarta					
Location	: Central Jakarta					
Work Items	: Pile and Foundation Work					
Function	: Visual					
No	Components	Function			Worth (Rp.)	Cost (Rp.)
		Verb	Noun	Categorize		
1.	Pile and Foundation Work	Increasing Strengthening	Wall resistance Structure	Primary Primary	Rp. 13.948.124.731,37	Rp. 14.187.608.740,71
		Protecting	Ground Surface	Secondary		
		Cover up	Ground Surface	Secondary		
Total					Rp. 13.948.124.731,37	Rp. 14.187.608.740,71
Cost/worth =					1,72%	

From the Functional Analysis which has a C/W value above 1 is the Pile and Foundation work item. Pile and Foundation work includes the work of River Stone Pile Structures, foundation work, earthworks and transportation of Excavated Materials, become one unit because if there is a change in the plaster structure work it will affect other work, for example foundation, plaster and earth excavation. then it will proceed to the Creative Stage.

Creative Stage

This stage aims to find alternatives to achieve the function of the construction, by using several ways of selecting materials, or modifying several material items without reducing the main function of the object. After doing the analysis, an alternative is obtained that can be done by Value Engineering (VE) as follows:

1. Original (Alternative 1 River Stone Sheet) in accordance with the initial planning of river stone sheet pile

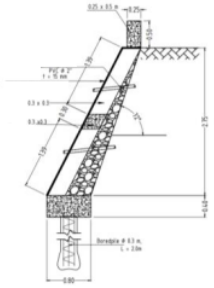


Figure 3. Alternative 1 (River Stone Sheets)

2. Alternative 2 (Concrete Sheet Pile)

Figure 4. Alternative 2 (Concrete Sheet pile)

After developing these alternatives, it is necessary to know how much the difference in construction costs for the modifications produced by these alternatives:

Table 4. Comparison of Alternative Construction Costs

NO	WORK ITEMS	COST	
		Alternative 1 (Stone Sheet Pile)	Alternative 2 (Concrete Sheet Pile)
1	River stone plaster structure work	Rp 8.656.004.527,03	Rp 6.641.162.533,60
2	Foundation work	Rp 4.771.520.832,43	Rp 4.704.995.635,20
3	Earthworks	Rp 375.072.731,91	Rp 1.811.013.851,91
4	Transport of Excavation	Rp 145.526.640,00	Rp 1.030.436.720,00
TOTAL		Rp 13.948.124.731,37	Rp 14.187.608.740,71
DIFFERENCE			Rp 239.484.009,34
PERCENTAGE			1,72%

With the difference in construction costs between Alternative 1 (stone sheet pile) and Alternative 2 (concrete sheet pile) is a weight of 1.72%.

Table 5. Alternatives for Piling and Foundation Work

Description	IDE
Alternative 1 (Stone Sheet Pile)	Bore Pile Foundation, River Stone Sheet Piles
Alternative 2 (Concrete Sheet Pile)	Footing Foundation, Concrete Sheet Pile

Evaluation Stage

The work to be selected based on predetermined criteria will be determined at this evaluation stage. Cost is not the most important criterion when selecting alternative ideas because the advantages and disadvantages and the characteristics of the work are the basis of alternative selection. Cost, turnaround time, maintenance, ease of installation, number of workers, required work equipment, wasted material, technology/modernization, and the degree of material damage are the main criteria for selecting alternative ideas.

In the Sentiong River Normalization activity, there are several types of construction that can be used, among others, stone sheet piles, concrete sheet piles and piles. Especially for piles, in 2019 the DKI Jakarta Provincial Water Resources Service had carried out the

Sentiong River Normalization activity with the type of pile construction, but there were several obstacles so that the implementation was not optimal, such as cracked residents' buildings and difficult material placement, so the piles were not included in the alternatives offered in this study. In terms of evaluation, the most promising alternative is concrete sheet pile with a cost of IDR. 14.1 billion considering cost is not the only criterion used, but consideration of periodic maintenance of the chosen alternative also affects long-term costs.

Development Stage

This Development Phase uses Life Cycle Cost (LCC) Analysis by taking into account the costs incurred as a result of this project starting from construction costs, routine maintenance costs and periodic maintenance costs in accordance with the planned construction life of 50 years.

Table 5. Results TableLife Cycle Cost Analysis (LCCA)On Piling and Foundation Work

No	Component Types	Type of Construction	
		Alternative 1 (Stone Sheet Pile)	Alternative 2 (Concrete Sheet Pile)
1.	Total Present Worth Life Cycle Cost	Rp. 32.936.590.219,19	Rp. 30.759.926.950,57
2.	Life Cycle Saving		Rp. 2.176.663.268,61
3.	Presentage of Cost Saving to the Total Original Cost		15,61%

From the results of Life Cycle Cost Analysis (LCCA) obtained Life Cycle Saving for 50 years in alternative 2 (concrete sheet pile) of IDR. 2.1 billion or 15.61% compared to alternative 1 (stone sheet pile), even though at the construction stage Alternative 2 (concrete sheet pile) is IDR. 239 million or 1.72%, but there are savings over the design life of 50 years in alternative 2 (concrete sheet pile) compared to alternative 1 (river stone sheet pile).

Presentation Stage

Based on the development stage, the alternative used is alternative 2 (concrete sheet pile) because it is in accordance with the calculation results of Life Cycle Cost Analysis (LCCA)there is Life Cycle Saving for 50 years with a savings of 15.61% compared to alternative 1 (pile stone plaster).

Recommendation Stage

From the results of the Life Cycle Cost Analysis (LCCA) the alternative that is recommended is Alternative 2 (concrete sheet pile) because even though it is more expensive from an initial development point of view, there is efficiency in the 50 year design life.

CONCLUSION

Based on the results of this study, it can be concluded as follows:

1. Pile and Foundation works are work items in the Sentiong River Normalization Project in Central Jakarta which have the potential to be reduced based on the Value Engineering method, with a value weight of 97.81% (Pareto Analysis).

This work includes River Stone Pile Structures, foundations, earthworks, and transportation of Excavated Materials, where these works are interrelated with one another so that changes to the plaster structure work will affect other works, such as foundations, sheet piles, and earth excavation.

2. The functional model of the work object that is applied in Value Engineering in the Sentiong River Normalization Project in Central Jakarta is Pile and Foundation works. This work serves to increase the resistance of the wall, strengthen the structure, and protect and cover the ground surface.
3. There are two alternative creative ideas that have the potential to be implemented in the Value Engineering Project for the Normalization of the Sentiong River in Central Jakarta based on the Creative Stage in this study, namely using an alternative to stone sheet piles and an alternative to concrete sheet piles.
4. From the results of the Life Cycle Cost Analysis (LCCA) with an estimated construction life of 50 years, the alternative that best meets the optimization criteria is Alternative 2 (recrete sheet pile) with a cost savings of 15.61%.

This conclusion provides an important guide for decision makers in the Sentiong River Normalization project in Central Jakarta to optimize budget use and choose the most efficient alternative in terms of cost and quality of construction. Future research may involve risk analysis methods in river normalization projects. Also be able to assess the impact of design changes on technical, environmental and financial risks and identify effective mitigation strategies to minimize risks that may arise.

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