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Analysis Value Engineering at Work Apartment Building Wall

Arna Salsabila, Desy Setyowulan, Eva Arifi

Civil Engineering, Faculty of Engineering, Brawijaya University, Malang, INDONESIA

E-mail: salsabilaarna@gmail.com

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ABSTRACT

It was Optimizing resources to analyze cost efficiency in implementing construction projects. One method that can be used for resource optimization is value engineering (VE). Value engineering (VE) as a management technique to determine the efficiency between the cost and performance of a product or project and stay on appearance, quality, and maintenance. Then value engineering is applied to the construction of apartment buildings to get cost efficiencies from the initial budget planning. This study aims to determine the effectiveness of value engineering in the construction of apartment buildings, especially in-wall installations. The VE method consists of five stages: The information stage, the creativity stage, the analysis stage, the development stage, and the presentation stage. Information stage, data collection in the form of cost planning, detail engineering design, work plan and terms. Based on the data obtained, the total contract value for the apartment building is Rp. 87,328,000,000. wall installation as one of the highest cost contributors. There are two alternative recommendations, namely sandwich panel walls and precast walls. The analysis found that the sandwich panel wall has the most efficient value, namely the total RAB value of 2.5% from the initial plan.

Keywords: optimization source power; value engineering; work wall.

INTRODUCTION

Each project implementation has different characteristics from other projects, thus requiring different completion methods (Diputera et al., 2018). Problems often encountered include inefficient materials, unskilled human resources, and delays in completion time resulting in wasted costs (Diputera et al., 2018). In the event of a waste of costs, a review of the project method used is carried out by reviewing project planning for project implementation to save costs without reducing the function of the project. One of the cost optimization methods is Value Engineering (VE) a management technique that can reduce unnecessary costs without lowering the value or function of the building. (Berawi, 2014) states that in increasing the value of the project, the Value Engineering method is used so that it gets the maximum value.

Construction of an apartment building with a project value of IDR. 87,328,000,000.00 consisting of fourteen floors, two basement floors, eleven floors of bedrooms and service areas, and one rooftop floor. There is a weekly deviation of 4% -6%, so value engineering is needed for cost efficiency without changing function and quality. The author is interested in analyzing value engineering for apartment development projects to get more efficient results. This study's results can be used as a reference for the construction of buildings with the same characteristics.

RESEARCH METHODS

Value engineering

Value Engineering is an organized and creative approach that aims to identify the required costs (Miles, 1972). The purpose of the Value Engineering analysis applied is to eliminate unnecessary expenses and find alternatives to meet needs at the lowest price without reducing the quality of

construction (Rani, 2022). The steps in implementing Value Engineering consist of two stages, namely (SAVE, 2007):

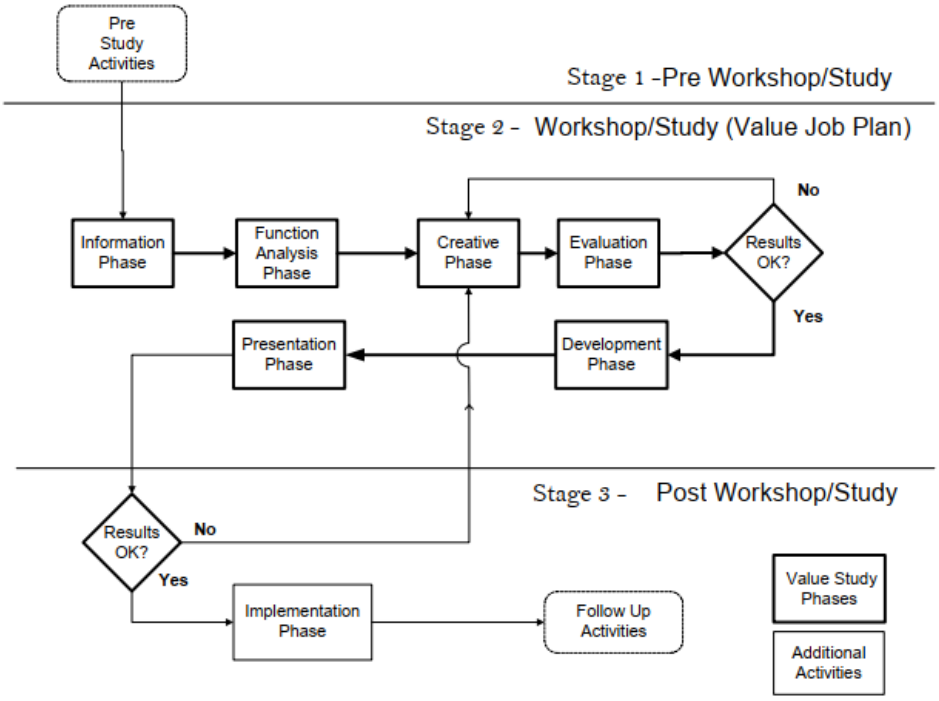

Figure 1. Value engineering process flow Source: SAVE

Wall

The wall is one of the elements of the building that limits one room to another. The wall functions as a barrier between the outer and inner space, as a barrier to light, wind, rain, dust, and others that come from nature, as a room divider in the house, to separate private space and public space and as an artistic function. Certain (Firdaus, 2019). Walls have three types, as follows (Manto, 2012):

a. Non-structural walls

A non-structural wall is a wall that does not support loads and only acts as a barrier. If the wall is removed, the building will remain standing. There are several non-structural wall materials, such as adobe, wood, glass, lightweight brick, and red brick.

b. Structural Wall

Structural walls function as a building structure and support the roof and columns that do not use cast concrete. The material used for structural barriers is usually red brick.

c. Partition Wall or insulation

Partition or insulation walls are vertical boundaries in the room/interior. Partition walls or insulation materials include plywood, wood, calcium board, and gypsum.

RESEARCH METHODS

This research type is descriptive qualitative research, which is a structured and systematic process consisting of several stages. This research takes a case study on the Apartment Building Development project.

At the data processing stage, there are data processing steps. The first is the identification of problems that occur in construction projects. Then the data collection stage determines the work items to be carried out by applying value engineering. The data used consists of 2 types of data: primary and secondary. The preliminary data includes budget plan data, work unit price analysis, and detailed engineering drawings. Secondary data as supporting data for reference and input in the application of value engineering, data in the form of interviews, field surveys.

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The function analysis stage is to determine the feasibility of the selected work items at the data collection stage, where value engineering analysis will be applied. At this stage, two methods are used: the breakdown cost and the Pareto diagram. Next is the creativity stage, alternative recommendations based on brainstorming, current information, and experience. Alternative suggestions given do not change the type or function of the building.

An analysis of each alternative recommendation presented at the creativity stage is carried out at the development stage. Alternative suggestions are selected based on the most efficient efficiency value. Next is the stage of presenting the chosen alternative to related parties so that it can be implemented or used as a recommendation. So that it can be concluded that the results obtained after conducting engineering value analysis and provide suggestions for further research.

Data Analysis

The stages in data analysis management are to carry out (initial) Realization Observation or Problem Identification, followed by data collection. After the data is obtained, the work items will be identified, which will be implemented by applying value engineering. Then collect alternative recommendations for selected work items, and analyze each alternative suggestion to find alternative recommendations with the most efficient value. An alternative analysis is carried out by calculating the budget plan.

RESULTS AND DISCUSSION

Information Stage

In the earliest stage in the process of implementing value engineering, at this stage data collection for the construction of apartment structures is carried out.

Table 1. Recapitulation Cost Project

NO	DESCRIPTION	TOTAL (IDR)
A	Preliminary Work	6,200,100,000
B.	Structure Work	
	Sub Structure Work - Foundation	5,330,831,045
	Upper Structure Work	24,473,668,082
	Other jobs	272,850,000
C.	Architectural Work	29,581,747,066
D.	Mechanical and Electrical Work	13,547,738,519
	Total	79,406,934,712
	Rounded up + 10% VAT	87,347,000,000

Table 2. Plan Breakdown Budget Cost All Sub Jobs

NO	DESCRIPTION	AMOUNT (IDR)
1	Floor works 1 - 12	27,267,920,281.86
2	Upper Structure Work	24,473,668,081.98
3	Mechanical And Electrical Work	13,547,738,519.40
4	Preliminary Work	6,200,100,000.00
5	Sub Structure Work - Foundation	5,313,697,733.00
6	Upper ground floor Work	1,281,732,444.45
7	Lower Ground Floor Work	538,735,626.17
8	Ground Floor Work	493,358,713.41

9	Other Jobs	272,850,000.00

From Table 2 based on the work breakdown that has the highest value is the work on Floors 1-12 and the Upper structure work. The work is on floors 1-12 sub-work of architectural work and Upper structure work, including structural work, which includes formwork, concrete and ironing position.

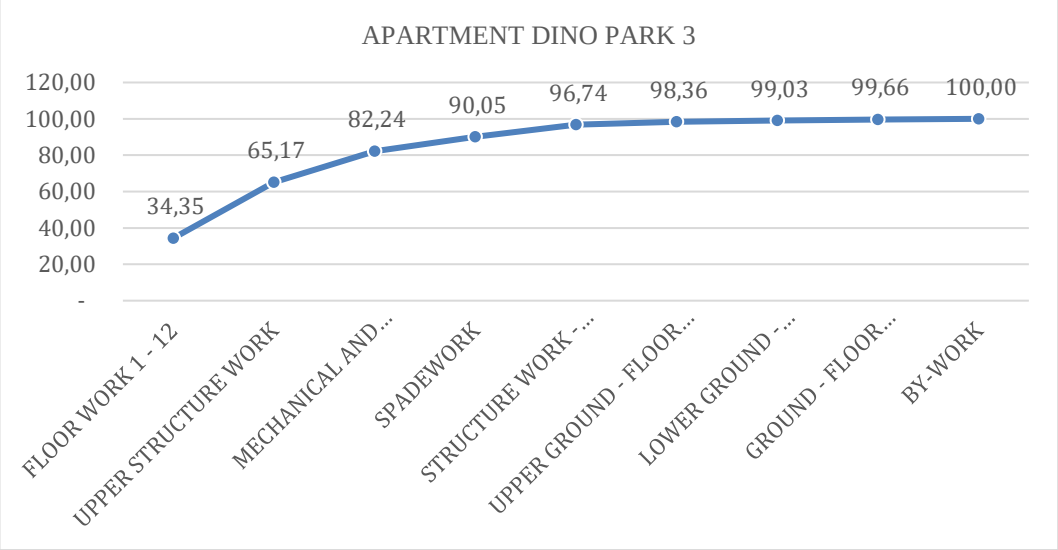

Figure 2. pareto breakdown diagram of an apartment building

In figure 2 the results of the Pareto law analysis, work on floors 1 - 12 and work on upper structures is feasible for applying value engineering. This work accounts for 80% of the total cost.

Creativity Stage

Table 3. Recommendation to wall work

NO	DESCRIPTION	CODE	DESCRIPTION
1	Initial Design	D0	Light brick (Thickness = 10 cm)
2	Alternative 1	D1	Sandwich panels Wall
3	Alternative 2	D2	Precast Wall

The initial design wall (D0) is a light brick wall 10cm thick. The alternative recommended design is alternative 1 (D1), a sandwich panel wall, and alternative 2 (D2), a wall precast. Table 3 is a description of alternative recommendations from the work wall.

Development Stage

Table 4. Analysis Results Alternative Work Wall

NO	DESCRIPTION	TOTAL PRICE (IDR)	DIFFERENCE (IDR)	DECREASE (%)
1	Light brick wall	82,851,000,000	-	0
2	Sandwich Panels Wall	81,856,000,000	1,830,569,131	2,5
3	Precast Wall	82,958,000,000	721,014,357	1.0

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Table 4 recaps the entire RAB after implementing each of the recommended alternatives. Sandwich panel walls are subject to decline by 2.5% of the total cost. Precast walls experienced a 1.0% decrease. Then the most efficient option is a sandwich panel wall because it has the highest settlement.

Table 5. Implementation Time Analysis

No	Job Name	Labor Coefficient	Labor	Volume	Total Working Time
1	Light brick wall	1.00	30.00	1614,46	54
2	Sandwich Panel Wall	0.57	30.00	1121.15	21
3	Precas*t* Wall	0.64	30.00	1121.15	24

In the analysis of alternative work execution times using an accumulated workforce of 30 people, the results are shown in Table 5. Sandwich panel walls are an alternative with the fastest completion time of 21 days. Sandwich panel walls got 33 days difference from light brick walls.

CONCLUSION

In the research that has been done, it can be concluded, based on the results of the Pareto analysis of the application of value engineering carried out on architectural work and sub-wall work. Changes were only made to the 1st – 12th-floor area. Two alternative recommendations were given: walls with sandwich panels and precast walls as a substitute for lightweight brick walls. The analysis results on each wall sandwich panel alternative experienced the most incredible efficiency. The savings obtained by applying an alternative sandwich panel wall application are Rp. 2.5% of the total cost, and the efficiency of implementation time for sandwich panel walls is 21 days, a difference of 33 days with light brick.

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