Implementation of Value Engineering for Construction Efficiency

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ABSTRACT---- ***Currently building construction project still has many problems in implementation when seen cost, quality, time and occupational health and safety remains a constraint both in the planning and implementation of building construction. Cost components were analyzed as cost efficiency value engineering on the structure of part of beams, columns and slabs, architectural wall. The study is based on the method SAVE, 2007 at the analysis stage phases of project information, analysis phase function of these components, then the stage of development which provide some alternative methods or materials renewable materials, after getting value cost efficiency seen from the cost / worth every component. The magnitude of the efficiency obtained in the project to calculate the value engineering of those components are respectively: beams with efficiency value of Rp. 1125013901 or equal to 29% of the initial value, a column with efficiency value of Rp. 1,494,028,557 or 16% of the initial value, wiremesh plate 1 layer and floordeck with efficiency value of Rp. 379 803 436 or 5% of the initial value, with a brick wall efficiency value of Rp. 566 440 559 or 8% of the initial value. beam with efficiency value of Rp. 1125013901 or equal to 29% of the initial value, a column with efficiency value of Rp. 1,494,028,557 or 16% of the initial value, wiremesh plate 1 layer and floordeck with efficiency value of Rp. 379 803 436 or 5% of the initial value, with a brick wall efficiency value of Rp. 566 440 559 or 8% of the initial value. beam with efficiency value of Rp. 1125013901 or equal to 29% of the initial value, a column with efficiency value of Rp. 1,494,028,557 or 16% of the initial value, wiremesh plate 1 layer and floordeck with efficiency value of Rp. 379 803 436 or 5% of the initial value, with a brick wall efficiency value of Rp. 566 440 559 or 8% of the initial value.***

Keywords---architecture, cost efficiency, construction management, building function

1. INTRODUCTION

On the implementation of the construction of a multistory building projects often have a huge cost. This is because less attention effectiveness and efficiency of use of material goods which have almost the same quality, but in terms of cost is considered more economical. Large financing a project into the limelight to be analyzed again with the aim to find savings. This led to many alternatives as basis for conducting studies that are not correcting the existing calculation or not correct the mistakes made by planners but rather leads to cost savings. Because it is necessary to have a Value Engineering so that the value or cost of the project can be reduced, without reducing the functionality and quality.

Apartment Building and Hotel The H Residence their items to be considered for the job reanalyzed to obtain a cost savings in order to produce a better cost.

2. LITERATURE STUDY

Value Engineering is a multidisciplinary decision-making process based on a systematic and structured. Perform analysis functions to achieve the best value of a project by defining the functions required to achieve the target value is desired and provide these functions at optimum cost, consistent with the quality and performance requirements (Berawi 2013).

According to (Zimmerman and Hart 1982) is a method of value engineering in the form of cost savings by using a

systematic approach to get the balance of the best functions of cost, strength and appearance of a structure on the project.

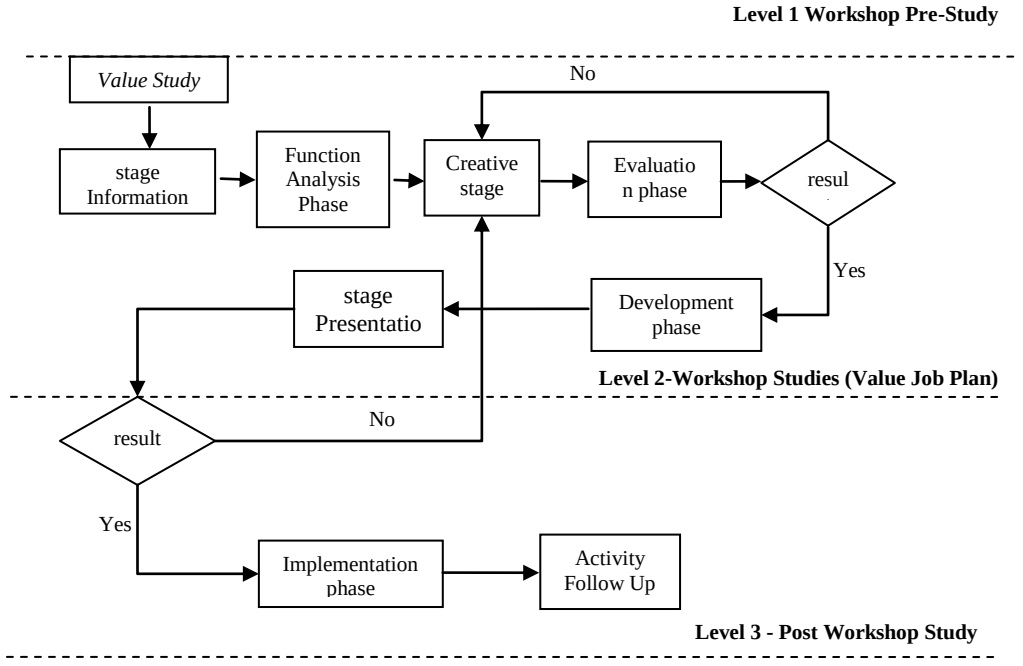
The concept of Value Engineering is the reduced cost of products or services involve engineering principles. These techniques attempt to achieve at least the same quality as planned at minimum cost. The planning process undertaken in the implementation of Value Engineering has always been based on a function needed and the value obtained. Therefore, value engineering is not:

1. *Cost cutting process*, Lowering the cost of the project by pressing the unit price, or sacrificing quality and appearance.
2. *Design Review*, Correcting the results of an existing design.
3. *Requirement done on all design*And not become a necessity of every designer to implement value engineering programs. (Chandra2014).
4. Correct errors made by the planning errors, or recount an existing RAB.
5. Reduce costs by lowering the appearance and quality.
6. Quality control. Value engineering seeks to achieve at least the same quality as planned at a cost as cheap as possible.

*Value Engineering*is a professional team approach in its application-oriented functions and carried out systematically used to analyze and improve the value products, design, facility, system, or service. Value engineering is a good methodology to solve problems or reduce the cost , can improve the performance or quality requirements set (Society of American Value Engineering, 2009).

Value Engineering is a solution to the problem was implemented using a collection of specific engineering, science, expert teams, creative approach organized whose aim is to define and eliminate costs that are not needed as costs that do not contribute to the quality, usability, age, and the appearance of the product and the consumer appeal (Miles 1971).

Standard methodology for assessing Value Engineering and the tools used to study, among others:



3. METHODOLOGY

3.1 Data collection

Primary data is data obtained by researchers direct include: quantity calculation mounted volumes.

Secondary data is data obtained by researchers from sources that already exist in the form: Budget Plan (RAB) for the building awoke, specifications or quality of the material that has been determined that the usual poured into Work Plans and Specifications and Picture For Construction already agreed upon by the owner and some of the consultants involved in the pre-construction phase.

3.2 Pareto Law Analysis

Identifying Budget Plan of the total jobs in the building will look for the value of the largest costs in value engineering will be whether it can provide cost efficiency by using the method of execution or new materials. Identification of cost values that will be of value engineering use Pareto's Law analysis in its determination. Here are the test steps Pareto's law:

1. Sort the cost of the work from the largest to the smallest
2. Sum total cumulative cost of work
3. Calculating the percentage of the cost of each job
4. Calculating the cumulative percentage
5. Plot cumulative percentage

3.3 Alternative Value Engineering

Provide alternative input form or method of implementation of new materials by considering the advantages and disadvantages of each alternative is given. With the hope of a given alternative will provide cost efficiency.

3.4 Unit price analysis

A way of calculating unit prices of construction work outlined in the multiplication needs building materials, wages, and equipment with the price of building materials, labor wage standards and prices lease/purchase of equipment to complete per unit of construction work. In this study, the authors calculate the unit cost of a Budget Plan and calculate the material requirements of each component of the work to calculate the unit price analysis of alternative/ inputs for value engineering.

3.5 Analysis of Cost / Worth

Analyze and calculate alternative cost value engineering, using analysis of cost / worth of function of the building as a whole is determined prior to determining the function of other elements. Then estimate the utility value (worth) of each subsystem or component to compare it to the estimated costs. Later utility value (worth) gives an indication of the value (value) means the lowest cost needed for the implementation of a specific function. It is not necessary for the immense accuracy. Utility value (worth) is only used as a mechanism to identify areas with potential savings and make up the value is high.

3.6 Evaluation result

Is the result of the calculation of unit price analysis with analysis of materials used on the alternative value engineering, which will get the value of the total employment with a given alternative if it can provide cost efficiency or not.

4. RESULT AND DISCUSSION

4.1 Building Data

Project data required to obtain basic information about a project. Berisis project data for general information on the project, the function of the building and project planning design limitations. Here is an overview of the project will be done VE studies.

Project type : Apartment Building and Hotel
Project name : The H Residence - Cawang
Project location : Jl. MT Haryono Kav 687, Cawang
Scope of work Structural Work, Works Architecture, Mechanical Electrical and Plumbing Works

Here is the Table Summary of Project Costs at The H Building Residence:

Table 1 : Summary of Project Costs

No.	Work item	Cost
1	Preparatory work	8.594.420.000
2	Structural Work	45.449.490.600
3	Architectural Works	40.747.069,800
4	Jobs Mechanical / Electrical	44.709.890.100
5	Add Work Less	-
6	Work Provisional Sum	4.030.000000
Total		143 530 870 500

4.2 Pareto analysis

Identifying Budget Plan of the total jobs in the building will look for the value of the largest costs in value engineering will be whether it can provide cost efficiency by using the method of execution or new materials.

Table 2 : Pareto Testing Results

No.	Work	Cost	% Prices	% Cumulative
1	Structural Work	45.449.490.600	31,67%	31.67%
2	Works M / E	44.709.890.100	31,15%	62.82%
3	Architectural Works	40.747.069.800	28,39%	91.20%
4	Preparatory work	8.594.420.000	5,99%	97.19%
5	Add Work Less	-	-	97.19%
6	Prov jobs Sum	4.030.000.000	2,81%	100%

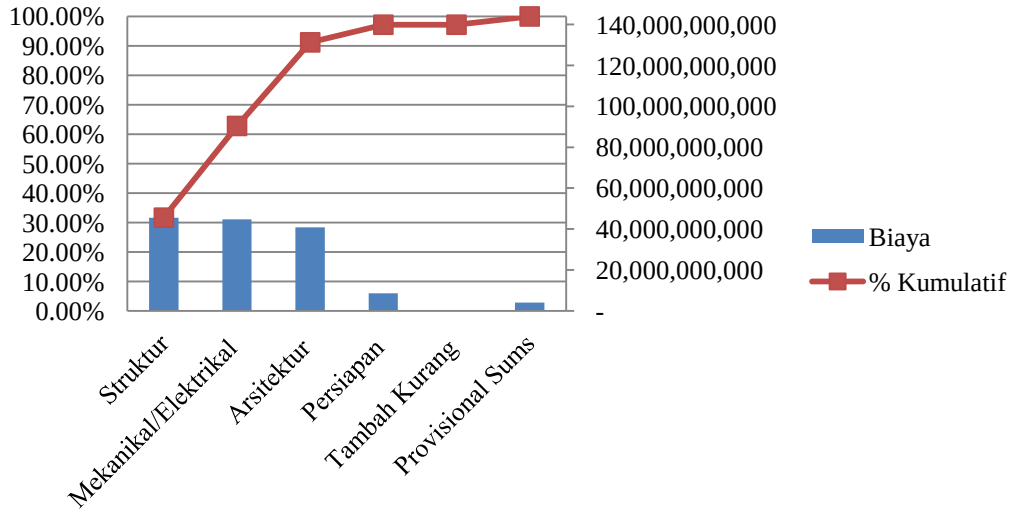


Figure 1: Graph Pareto Total Project

Table 3 : Pareto structure work

No.	Work	Cost	% Prices	% Cumulative
1	Structural Work	30,376,880,120	67%	67%
2	Works M / E	15,072,610,455	33%	100%

Table 4 : Pareto architectural work

No.	Work	Cost	% Prices	% Cumulative
1	Wall work	10,294,874,929	25%	25%
2	Works Door & Window	8,520,626,593	21%	46%
3	Floor job	6.620 617.247	16%	62%
4	Facade Works	5.546.499.757	14%	76%
5	Sanitary Pekerjaana	3.920.595.620	10%	86%
6	Other Work	2.586.844.568	6%	92%
7	ceiling Work	2.330.423.385	6%	98%
8	Outside Work	926.587 .668	2%	100%

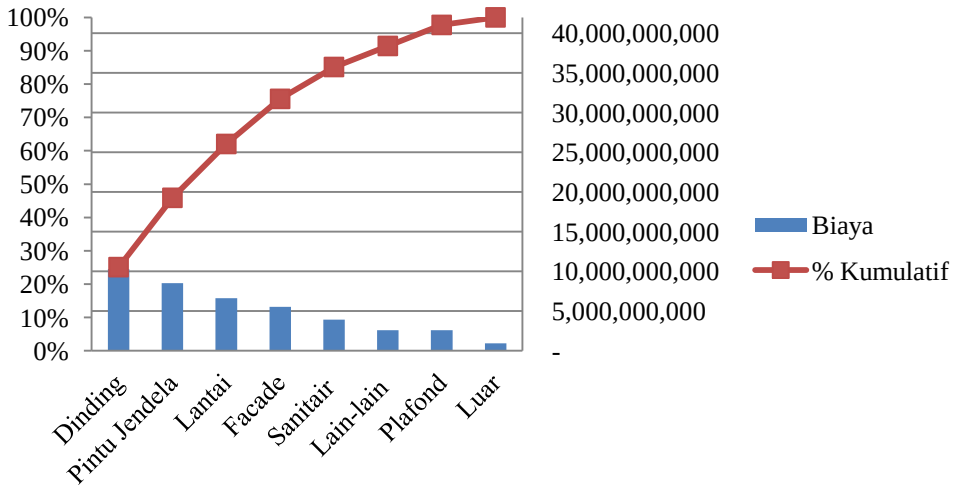


Figure 2: Pareto Charts Architecture

Pareto analysis of the results showed, for the work structure components taken beams, columns and slabs. As for the architectural work drawn wall components.

4.3 Alternatives for Value Engineering

This analysis is to analyze each stage of an alternative obtained from the phase of creativity. This stage is to reduce the quantity of ideas that should be identified are common to a short list of ideas with great potential to increase the value of buildings. At this stage of the evaluation will be conducted analysis of the advantages and disadvantages in order to get the most appropriate alternative. Here are the results of VE some work items, which are as follows:

1. Beam, using the existing reinforced concrete with conventional methods. Creative VE provides an alternative that is Precast.
2. Column, using the existing reinforced concrete with conventional methods. Creative VE provides an alternative that is Precast.
3. Plates, using the existing reinforced concrete two-way with conventional methods. Creative VE provides two alternate two-layer concrete reinforcement and concrete wiremesh wiremesh floordeck.
4. Wall, using the existing red brick wall. Creative VE provides two alternatives namely adobe and brick wall light.

4.4 Unit price analysis

Analysis of unit price is a way of calculating unit prices of construction work outlined in the multiplication needs building materials, wages, and equipment with the price of building materials, labor wage standards and prices lease / purchase of equipment to complete per unit of construction work.

Table 5 : Results of analysis of unit price (existing)

No.	Work item	Cost
1	Work conventional beam	9.486.492.802
2	Work conventional column	3.416.041.550
3	Work conventional plates	7.537.870.555
4	Wall work	7.195.639.945

Further analysis of cost unit price for each of the alternatives given for value engineering, which are as follows:

Table 6 : Results of analysis of unit price (alternative)

No.	Work item	Cost
1	Precast beams jobs	7.992.464.246
2	Work precast columns	2.811.531.760
3	Work plate (wiremesh 2 layers)	8.469.326.903
	Work plate (floordeck + wiremesh)	7.195.639.945
4	Job brick wall	6.847.937.950
	Work light brick wall	8.263.560.390

4.5 Analysis of Cost / Worth

Analysis of cost/worth or functions within the main base for the analysis of value engineering is what will differentiate VE of techniques other cost savings. This analysis helps the team VE in determining the lowest cost needed to carry out the functions that cost can be reduced and eliminated without affecting the performance or constraints.

The function of the building as a whole is determined prior to determining the function of other elements. The difficult part in the analysis function is estimating utility value (worth) of each subsystem or component to compare it to the estimated costs.

Utility value (worth) gives an indication of the value means the lowest cost needed for the implementation of a specific function. It is not necessary for the immense accuracy. Utility value (worth) is only used as a mechanism to identify areas with potential savings and make up the value is high.

Table 7 : Results of analysis of cost / wort

No.	Work item	existing	Alternative	Cost / worth
1	Precast beams jobs	9.486.492.802	7.992.464.246	1,19
2	Work precast columns	3.416.041.550	2.811.531.760	1,40
3	Work plate (wiremesh 2 layers)	7.537.870.555	8.469.326.903	0,89
	Work plate (floordeck + wiremesh)		7.195.639.945	1,05
4	Job brick wall	7.195.639.945	6.847.937.950	1,08
	Work light brick wall		8.263.560.390	0,90

4.6 Results Evaluation of Alternative Value Engineering

This phase is a phase which is done by the form of presentation or written report addressed to all parties involved in understanding the alternatives that will be chosen in the proposed value engineering.

Table 8 : Results of analysis of cost / worth

No.	Work item	Cost / worth	knot
1	Precast beams jobs	1,19	Worth
2	Work precast columns	1,40	Worth
3	Work plate (wiremesh 2 layers)	0,89	Unworth
	Work plate (floordeck + wiremesh)	1,05	Worth
4	Job brick wall	1,08	Worth
	Work light brick wall	0,90	Unworth

4.7 Toward Cost Efficiency Project Value

At this stage it is a phase in which alternative given on the value engineering affect the cost of the overall project value. The cost efficiency can be seen from the following table:

Table 8 : Results of analysis of cost / worth

No.	**Work item**	**Cost**	**Value Engineering**
1	Preparatory work	8.594.420.000	8.594.420.000
2	Structural Work	45.449.490.600	42.450.644.681
3	Architectural Works	40.747.069.800	40.437.050.390
4	Jobs Mechanical / Electrical	44.709.890.100	44.709.890.100
5	Add Work Less	-	-
6	Work Provisional Sum	4.030.000.000	4.030.000.000
	Total	143.530.870.500	140.222.005.171
	Cost efficiency		3.308.865.329
	% Cost Efficiency		2,31%

5. CONCLUSION

Based on the rare measures which have been carried out in accordance with the SAVE method 2007 for a value engineering, then obtained:

1. Evaluation of several components selected work are: building structure: columns, beams and plates, for wall architectural work. Are as follows :
   - Beam structure, providing an alternative precast cost efficiencies occur at Rp.1.494.028.557.
   - Column structure, providing an alternative precast cost efficiencies occur at Rp.1.125.013.901.
   - Plates structure, providing an alternative 2 (wiremesh 1 layer and floordeck) cost efficiency occurs Rp. 379 803 436.
   - Wall, providing an alternative 1 (brick) cost efficiency occurs Rp. 566 440 559.
2. With a total cost efficiency of the initial project value is Rp. 3,308,865,329 or 2.31% of the initial value of the project.

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