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Application of Value Engineering in The Work of Architecture Wall and Roof Work Convention Hall Building at Regency of Kediri East Java Indonesia

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ABSTRACT
Building budget plan project should be planned efficiently and optimally. In construction management there is a civil engineering disciplines that can be used to streamline costs. The science known as value engineering. Value engineering is a creative approach and planned with the aim to identify and streamline costs unnecessarily. In a construction project financing is often the case inflate the perceived no need or if it were to be reduced, especially in the construction of Convention Hall building at Regency of Kediri. Research aimed at any item of work that can be done value engineering, how Choose and taking into account the type of materials for the building construction more precise and efficient, and how large the cost efficiency obtained after the analysis of Value Engineering. Application of Value Engineering on the work done by replacing the use of wall materials of adobe bricks and wallcoverings from the frame and replaced using the ACP framework and Kalsiboard. While on the job for the roof edge work of the ACP also changed using metalsheet. This study aims to determine the magnitude of cost savings after the Value Engineering. Some processes were conducted including information gathering phase, creative phase, phase analysis and recommendation stage. Using Zero-one method to process the data and obtain the desired alternative. The results of the application of Value Engineering study conducted at Convention Hall Building construction in Kediri produce cost savings of Rp.3,444,425,325.00 or 6.31% of the entire project before tax of Rp.54,519,338,000.00.
Keywords - Convention Hall, Cost Savings, Value Engineering, Efficient

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I. INTRODUCTION

1.1 Background

In the construction of the Kediri Convention Hall building, both planners and contractors are always faced with the selection of appropriate design and implementation methods in order to realize a building that not only qualifies in terms of design and also in terms of economic. In this case the selection of design, dimensions and materials is very important to do, because it will show the quality and quality of the building

Value engineering is one of way to creative and planned approach with objective to streamline the costs required project. Value engineering is also used to find alternatives intend at generating costs that are more appropriate/lower than preplanned prices with functional constraints, structural strength and quality of work. In value engineering planning usually involves project owners, planners, experienced experts in their respective fields and value engineering consultants.

Evaluation method in value engineering used to analyze techniques and values of project, in which case a new alternative is sought for purpose of generating more efficient costs with functional constraints and task plan steps that can identify and cost optimize - cost of it and unnecessary effort. By making improvement to value of product without reducing any quality and security.

Construction project of Kediri Regency Hall Building located at Simpang Lima Gumul spend money Rp59,971,270,000.00. Total of costs for architectural and roofing work spend Rp15,531,435,000.00. From the architectural component and roof the writer only takes focus on the work of walls and roof, because work costs are relatively expensive compared to other work items and also age of material used in wallcovering work and the roof has been damaged in some parts. It is expected that with value engineering analysis can be done by saving by suggesting several alternatives to be analyzed in applying value engineering with the right concept to obtain alternative of replacement material without reducing function of the building. In the hope that substitute material is cheaper, faster

to work, and does not reduce the quality and aesthetics of the starting material.

1.2 Problem of the Study
According to the background, it can be formulated as follow:
1. What kind alternative of material is most effective and efficient after done value engineering in the work of wall and roof architecture at Project Development Building Convention Hall Kediri Regency?
2. How much cost savings and percentage of the overall building obtained in the work of wall and roof architecture on project development Convention Hall Kediri after value engineering?

1.3 Research Purpose
We can conclude the purpose of this research base on the problem above, it can be formulated as follow:
1. Obtain most effective and efficient job alternative after value engineering in the work of wall and roof architecture at the Covention Hall Building Project Kediri Regency.
2. Calculate cost savings and percentage of the overall building obtained in work of wall and roof architecture at development project Convention Hall Kediri District after done value engineering.

II.   REVIEW OF RELATED LITERARURE
2.1 Value Engineering
Zimmerman dan Hart in Donomartono (1999) Value Engineering is "a value study on a project or product that is being developed. It analisys the cost the project as it being designed". The approach is to analysis of value to its function, so that value engineering always be oriented to value. In value engineering, performance improvements and not by reducing costs. Cost savings obtained are not the main results to be achieved from the use of the value engineering method.With value engineering applied, it is expected that product will have an increase. Value engineering is always based on the required functions and values obtained.

2.2 Information Stage
Gather much information as possible which includes information about the system, structure, and cost of the object being studied. Techniques can be used in the information stage, breakdown, cost model and function analysis.

2.3 Creative Stage
According Hutabarat (1995) creative stage is develop as many alternatives as possible that can fulfill the primary or principal functions. For that needed emergence of ideas to multiply alternatives to be selected.

2.4 Analysis Stage
Evaluate alternatives that have been established and make the largest value selection. This stage also answers question of what to do and how it costs.
Analysis of ideas or alternatives. Bad ideas are eliminated. Alternatives or ideas that arise formulated and considered the advantages and disadvantages are viewed from various angles, then made a ranking of the assessment results. In evaluating can use technique among others, paired comparison method.

2.5 Development Stage
According Donomartono (1999) at this stage of development it prepares all ideas or opinions as a whole to be examined into preliminary designs, drawn up solutions, estimated in life cycle cost from original design and with newly proposed designs, then presented value. According Pujawan (1995) life of cycle cost in an item is the amount of all expenditures associated with the item since it is designed until it is not used anymore.

2.6 Recommended Stage
This stage oral presentation to all parties involved in understanding alternatives to be selected in a value engineering proposal that can be submitted briefly, clearly, quickly and without discouraging either party. This recommendation will be used to convince the owner or decision making.

2.7 Alternative Wall Materials and Roof
Materials technology of building materials evolves as need for strong and environmentally friendly building, one of them are light weight autoclave aerated concrete; lightweight concrete lightweight concrete brick; brick; lightweight concrete. the roof is the cover of a house or building at the top; roof metal sheet (made of aluminum and zinc); polycarbonate roof; acrylic roof.

III.   RESEARCH METHODOLOGY
In this research using research method type of descriptive. According to Bogdan and Biklen (1982) case studies are a detailed test of one background or one subject or one document storage or one particular event. Winarno (1982) limits the case study approach as an approach by focusing on an intensive and detailed case. While Yin (1986) provides more technical limitations with an emphasis on its characteristics. Ary, Jacobs, and Razavieh (1979) explained that in case studies the researcher should try to test the unit or individual in depth.

Before conducting the research process, researchers must conduct preparation stage, including collecting or mencarai project data. Search data can be done either to consultants, contractors or to Public Works Department that handles large projects. After obtaining the project data then the researchers conducted a survey to the project site to get an overview of field conditions. In addition, the researchers also conducted literature studies both through books libraries, internet, regulations of the Ministry of Public Works and other regulations that can be used as reference material and additional.

Data used in this study are grouped into 2 (two), namely: Primary data used in conducting value engineering analysis, in the form of technical data from the project, such as bestek drawings, budget plan and work plan and terms; Secondary data are supporting data which can be used as input and reference in value engineering analysis, such as list of unit price and worker analysis, material data or building materials used, heavy equipment data, labor data, building regulations buildings from the Ministry of Public Works and other data that can be used as a reference in analyzing value engineering.

From datas that has been collected, it is done value engineering analysis to produce a saving cost. Value engineering analysis is conducted in three stages, namely: information stage, efforts to obtain as much information as relevant to the study object to be evaluated, where the data and information are processed according to the need in the next stage; creative stage, in value engineering, creative thinking is a very important thing in developing ideas to bring up alternatives of elements that still fulfill that function, then organized systematically; stage analysis, calculate the value/cost of the work item with the offered design alternatives. In calculating the cost can be reviewed in terms of materials, labor, time and dimensions of work items. In this stage, delivering their contents by using the method of Paired Comparison.

IV.   ANALYSIS AND DISCUSSION
4.1 Information Stage
In conducting value engineering studies, originalitas planning data on the construction of Kediri District Hall building is necessary. This data used as a reference for the function and usefulness of the building will not change from original plan.

4.1.1 Project Initial Condition
In this Convention Hall building project, Value Engineering analysis will be done on wall and roof.

TABLE 1: Project Initial Conditions

NO		TYPE OF WORK
I		WALL
	1	Brick pairs
	2	1: 3 plaster for walls
	3	Frame and ACP 4 mm wall coverings
II		ROOF
	1	Glass stopsol 8 mm blue tempered
	2	Frame and ACP 4 mm roofing coating

Source: CV Ghaniyyu Engineering and Dinas PU Kab. Kediri

4.2   Creative Stage
The ideas that emerge can be proposed in order to do the application of value engineering on development projects Kediri Convention Hall Building.

4.2.1 Option of Work Item
Because the structural work has a dimension (size) that meets the applicable standard security requirements as well as the new value engineering analysis will be applied after the preparatory work, then there will be 2 (two) types of work to be done value engineering there are: wall work and roof work.

Alternative design work wall and roof work on the application of value engineering is as follows:
1 Wall
There are two potential jobs for doing value engineering there are:
a Wall, ie replacing brick material with other alternatives: brick, light brick, or lightweight concrete.
b   Wallcovering, ie replacing ACP material with other alternatives: kalsiboard, GRC panel, or stainless plate material.
2 Roof
Planning use new material on the roof cover job by not changing the function of the building. The new material planning is as follows:
a   Replace the curved glass roof cover with other alternative materials: polycarbonate, acrylic, or metalsheet.
b   Replace ACP roof cover with other alternative materials: polycarbonate, acrylic or metalsheet.

4.3   Analysis Stage
In this stage an analysis of ideas or alternatives is provided. Bad ideas are eliminated. Alternatives or ideas that arise formulated and considered the advantages and disadvantages are viewed from various angles, then made a ranking of the assessment results. In evaluating it can use

techniques such as, zero one method and evaluation matrix.

4.3.1 Wall Analysis

      From the selected alternative rankings of wall work, then we look for the weights of each criterion using the Zero-One method as seen in Table 2 below.

TABLE 2: Zero One Method for Determining Weights

Criteria	No	Criteria						Total	Weight
		A	B	C	D	E	F		
Cost	A	X	1	1	1	1	1	5	0,333
Implementation of Field	B	0	X	1	1	0	1	3	0,200
Technology	C	0	0	X	0	0	1	1	0,067
Quality Control	D	0	0	1	X	0	1	2	0,133
Strength	E	0	1	1	1	X	1	4	0,267
Aesthetics	F	0	0	0	0	0	X	0	0

Sumber : Hasil Analisa

      The method of implementing this zero one method is to collect functions of the same level, then arranged in a square shaped zero one matrix. After that, the assessment of the functions in pairs, so that matrix will be filled X. The values in this matrix are then added by line and collected in sum column. And the results of calculations can be seen as below.

TABLE 3: Relative Weighing Alternative Selection

No	Alternative	Criteria						Total	Rank	Selected
		A	B	C	D	E	F			
		0,333	0,200	0,067	0,133	0,267	0			
1	Batako	4	4	4	4	3	2	3,733	1	1
		1,332	0,800	0,268	0,532	0,801	0			
2	Lightweight Brick	2	3	2	3	3	4	2,600	3	
		0,666	0,600	0,134	0,399	0,801	0			
3	Light Concrete	2	2	1	2	4	4	2,467	4	
		0,666	0,400	0,067	0,266	1,068	0			
4	Brick	4	4	4	3	2	2	3,333	2	
		1,332	0,800	0,268	0,399	0,534	0			

Source: Analysis Result

4.3.2 Roof Analysis

      From the selected alternative rankings of wall work, then we look for the weights of each criterion using the Zero-One method as seen in Table 4 below.

TABLE 4: Zero One Method for Determining Weights

Criteria	No	Criteria						Total	Weight
		A	B	C	D	E	F		
Cost	A	X	1	1	1	1	1	5	0,333
Implementation of Field	B	0	X	1	1	0	1	3	0,200
Technology	C	0	0	X	0	0	1	1	0,067
Quality Control	D	0	0	1	X	0	1	2	0,133
Strength	E	0	1	1	1	X	1	4	0,267
Aesthetics	F	0	0	0	0	0	X	0	0

Source: Analysis Result

      The method of implementing this zero one method is to collect functions of the same level, then arranged in a square shaped zero one matrix. After that, the assessment of the functions in pairs, so that matrix will be filled X. The values in this matrix are then added by line and collected in sum column. And the results of calculations can be seen as below.

TABLE 5: Relative Weighing Alternative Selection

No	Alternatif	Criteria						Total	Rank	Selected
		A	B	C	D	E	F			
		0,333	0,200	0,067	0,133	0,267	0			
1	Polycarbonate	3	4	4	4	3	2	3,400	2	
		0,999	0,800	0,268	0,532	0,801	0			
2	Acrylic	2	2	2	2	2	4	2,000	3	
		0,666	0,400	0,134	0,266	0,534	0			
3	Metalsheet	4	4	4	4	3	2	3,733	1	1
		1,332	0,800	0,268	0,532	0,801	0			
4	Blue Tempered Glass	2	2	1	1	3	4	2,067	4	
		0,666	0,400	0,067	0,133	0,801	0			

Source: Analysis Result

4.4 Development Stage

      In this stage, the alternative chosen from the anallic phase, calculated cost. For more details the results of the cost analysis after application of value engineering can be seen in the following table.

TABLE 6: Sub Works Cost Analysis After Value Engineering

	JOB DESCRIPTION	DESIGN VE
	Wall	
1	Batako	Rp.459.988.200,00
2	Kalsiboard and Frame	Rp.312.453.600,00
	Roof	
1	Curved Roof Cover Metal Sheet	Rp.276.294.200,00
2	Closing Edge of Metal Sheet Edge	Rp.236.583.900,00

Source: Analysis Result

4.5 Presentation Stage

      As the final stage of value engineering method, at this stage a proposal is made by presenting a large cost savings and a large percentage of savings from construction of Kediri District Hall Building can be seen in the following table.

TABLE 7: Cost Analysis Wall Item of Value Engineering

Existing		Alternatif VE	
1. Brick Wall	Rp. 543.784.500,00	1. Batako	Rp. 459.988.200,00
2. Wallcoverings ACP	Rp. 2.634.324.525,00	2. Wallcoverings Kalsiboard	Rp. 312.453.600,00
COST			
Existing		*Value Engineering*	
Rp. 3.178.109.025,00		Rp. 772.441.800,00	
Savings			
Rp. 2.405.667.225,00			
75,69 %			

Source: Analysis Result

TABLE 8: Cost Analysis Roof Item of Value Engineering

Existing		Alternatif VE	
1. Glass Roof Cover	Rp. 763.190.000,00	1. Curve Roof Cover Metalsheet	Rp. 276.294.200,00
2. Edge Roof ACP	Rp. 864.315.900,00	2. Edge Roof Metalsheet	Rp. 312.453.600,00
COST			
Existing		*Value Engineering*	
Rp. 1.627.505.900,00		Rp. 588.747.800,00	
Savings			
Rp. 1.038.758.100,00			
63,82 %			

Source: Analysis Result

Based on Table 7 and Table 8, obtained:
Initial Design = Rp. 4.805.614.925,-
Value engineering design = Rp. 1.361.189.600,-
Cost saving or cost reduction after the implementation of value engineering in the construction of Convention Hall Kediri Rp.3,444,425,325.- for 4 (four types of work above)
Total Project Cost before tax Rp.54,519,338,000.-. Percentage of the entire project (before tax) after Value Engineering is 6.31%.

V. CONCLUSION

From result and discussion of this research that have been described on the previous chapter, we can conclude that:

1. Alternative type of material selected after value engineering in the construction of the Convention Hall Building in Kediri Regency are:

   a. Wall architecture work: replace wall filler material with bataco; replace the outer wall covering material with the frame and kalsiboard.

   b. Roof work: replacing curved roofing materials with metal sheets; the edge roof used metalsheets.

2. Amount of cost savings after applying value engineering is Rp.3.444.425.325,00 with a percentage of 6.31% of the project value (before tax) of Rp.54.519.338.000,00. So the total cost of the project after the Value Engineering analysis is Rp.51.074.912.675,00 (without calculate tax).

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