

Application of Function Analysis using Function Analysis System Technique (FAST) Diagram on Taman Sari Apartment Construction Project

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Abstract

Construction projects require costs as a very important element in their implementation. There are several alternative methods that can be used as a rationale for conducting studies on cost savings. One of the alternatives that can be used for savings by eliminating unnecessary costs so that the value of the project can be reduced is Value Engineering (value engineering). One of the important stages in VE is the analysis of functions whose purpose is to identify the functions that are most beneficial for the study of VE. The method used in the analysis of this function is the Function Analysis System Technique (FAST) Diagram with the aim of defining the function of each work item analyzed and can review the basic functions that are used as guidelines in the selection of alternative designs for cost savings. In the Taman Sari Apartment construction project, a function analysis was carried out on high-value work items, namely structural work, frame work, door and window leaves, wall work, floor work and roof covering work. On the work of the structure identified the basic function of the work of the structure is to plan an alternative design with outputs in order to obtain cost efficiency. Then in the work of the frame, door leaves and windows have the basic function of planning an alternative design with output to be able to provide space access. Wall work with basic functions as a room divider to provide comfort and privacy as the resulting output. In floor work with the basic function of closing the floor base and the output is to beautify the room. For roof covering work has a basic function by calculating the roof load and output to obtain cost efficiency. After the implementation of the functioning analysis stage, cost savings are carried out by identifying and reducing unnecessary costs without reducing the quality and function level of the project itself.

Keywords: cost efficiency, value engineering, function analysis, FAST Diagrams

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1. Introduction

The rapid development of the construction world accompanied by increasingly sophisticated technology makes many choices in carrying out development activities. In the construction activities of a project requires costs which are a very important element in its implementation and must pay attention to work methods to the selection of materials used.

There are several alternative methods that can be used as a rationale for conducting studies on cost savings. One of the alternatives that can be used for savings by eliminating unnecessary costs so that the value of the project can be reduced is Value Engineering. Cost-effective design, perhaps using value engineering (Venkataraman & Pinto, 2011). Value Engineering according to (Chandra, 1986, 2014) is an organized effort to analyze a problem that aims to achieve the desired functions at total cost and optimal final results. Value engineering is used to find an alternative or idea that aims to produce costs that are better or lower than the previously planned price with functional and quality constraints of work (Miles, 2015). Re-analysis of a cost budget plan in the construction of a project is one of the options in order to get the most cost-effective budget, but still in accordance with applicable regulations and standards (Berawi, 2014). Cost-effective procurement is merely one of three completely interdependent facets of financial control-the other two being budgetary control and value engineering (Williams, 1996). To making cost-effective choices for building-related projects can be quite similar whether it is called cost estimating, value engineering (Fuller, 2010).

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One of the stages carried out in the VE analysis is to perform a function analysis. Function analysis is one of the initial stages of the VE analysis (Diputera, 2018). The method used in the analysis of this function is FAST Diagram with the aim of defining the function of each work item analyzed and being able to review the basic functions that are used as guidelines in the selection of alternative designs for cost savings (Dell’Isola, 1997).

The application of function analysis with FAST diagram is carried out on the Taman Sari Apartment construction project. This apartment will be rebuilt in a different location with a cheaper budget target in order to achieve greater profits. Therefore, it is necessary to conduct a review so that the goal of obtaining cost efficiency in project implementation can be achieved and remain in accordance with the basic functions of the building without affecting the quality and quality.

2. Materials and Methods

Based on the job plan in THE VE, the first stage that must be passed is to collect as much information as possible about the design of the project planning from general data to the desired design limitations in the project. Then proceed to identifying work items at high cost. The data needed is the project data needed to get basic information about a project. Project data contains general project information, project building functions, and project design constraints (Wieggers & Beatty, 2013). Information about the project is obtained by asking directly to the consultant or implementer who handles the project or the owner of the project.

After collecting the information, a function analysis is then carried out. The function analysis stage is the most important stage in VE because this function analysis distinguishes VE from other cost-saving techniques. At this stage, a function analysis will be carried out using FAST Diagrams so that the lowest costs are obtained to carry out the main functions, supporting functions and identify costs that can be reduced or eliminated without affecting the quality and quality of the building.

3. Result and Discussion

The initial stage that is carried out before carrying out the function analysis is to fill in the work items to be analysed using a pareto diagram. The work items analyzed are at a cost of 20% of work items or activities whose cost is above 80%.

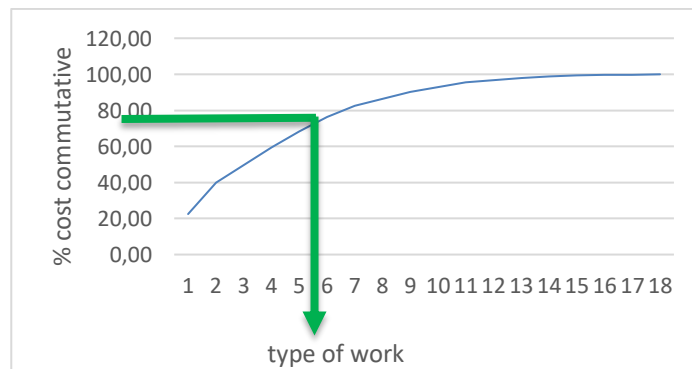


Figure 1. Pareto diagram for the entire work item

From Figure 2, it can be explained that the line that is green is the limit of work, it is explained that the horizontal arrow line is a limit of work with a high cost that reaches 80%, while the vertical arrow line shows the scope of the type of work that the VE study will do. Based on the pareto chart above, the components of the work items to be carried out by VE are located at numbers 1 to 7, namely structural work, MEP work, frame work, door and window leaves, wall work, floor work, roof covering work, and sanitary work. However, in this study, MEP and sanitary work was not reviewed by VE because the specifications on MEP work and sanitary work have been determined by the owner in accordance with the desired aesthetic.

3.1. Concrete Structure Work Function Analysis

The details of the structural work are those items of work that are within the scope of the work of the structure, it is said to be structural work because this work is directly related to the strength of the building both the strength of the building load-bearing from the lower foundation to the upper foundation. There are four main work items in the structure, namely concrete work, drilling, wire mesh and bekesting. The drilling and concrete work has the highest weight, so in this study will try to find alternatives to these jobs and later can reduce the excess costs of this work.

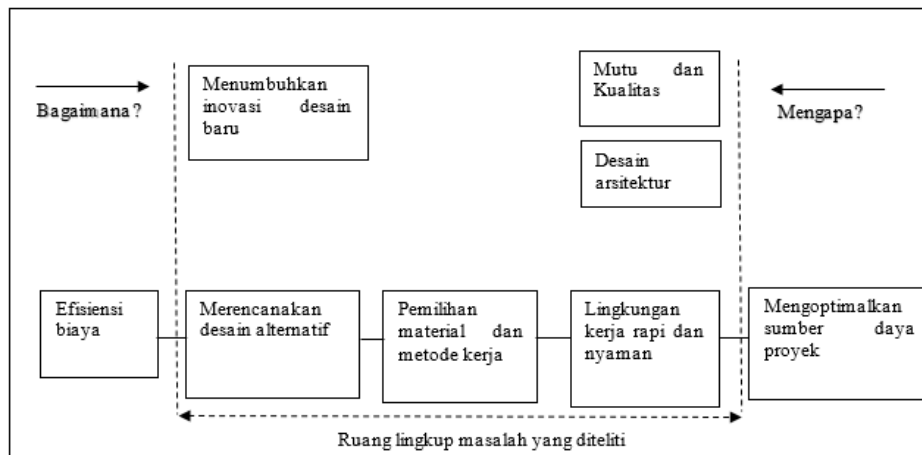


Figure 2. FAST Structure job diagram (in Indonesia)

In Figure 2 it is explained that the scope of the problem and the critical trajectory from left to right direction refer to the cost efficiency of the structure with the basic function of planning alternative designs and there are two secondary functions with the selection of materials and working methods, followed by a neat and comfortable working environment. Then the cause function (input) is to optimize the project resources and the output of that basic function is cost efficiency. From the analysis of the scope of the problem and the critical trajectory will cause functions that occur simultaneously such as, review of architectural design, quality and quality and get a goal function in the form of the emergence of new innovations that become a reference at the stage of creativity.

3.2. Job Function Analysis of Frames, Door leaves and Windows

Figure 3 explains that the scope of the problem and the critical trajectory from left to right refer to the basic function of planning alternative designs. Then there is the secondary function in the form of material quality strength and the equally important secondary function, namely access in and out of the air and limiting the room. The function of the cause (input) is the selection of materials and the output of the basic fungsi is to provide room access. From the analysis of the scope of the problem and the critical trajectory, it will later give rise to functions that occur simultaneously such as, maintenance and completeness of buildings and goal functions in the form of cost efficiency and design innovation.

3.3. Wall Work Function Analysis

In Figure 4 it can be explained that the scope of the problem and the critical trajectory from left to right direction refer to the basic function as a room divider. The secondary function required is the installation of walls and the selection of work methods that produce supporting functions in the form of ease of installation. The cause function (input) is to maximize the service life of the wall layer and the output obtained from the basic function is to ensure comfort and privacy. From the analysis of the scope of the problem and the critical trajectory will cause functions that occur simultaneously, namely maintenance and the purpose function in the form of cost efficiency and ease of maintenance.

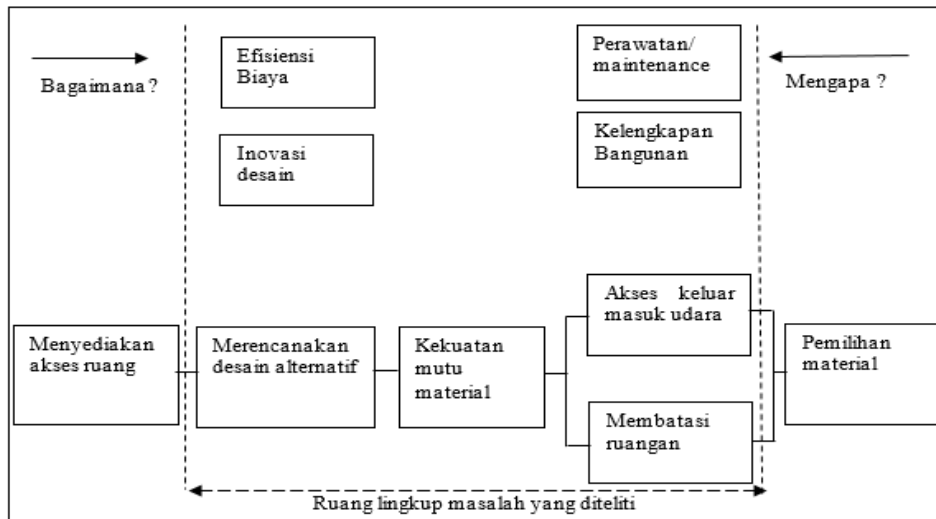


Figure 3. FAST Diagram of the work of frames, door leaves and windows (in Indonesia)

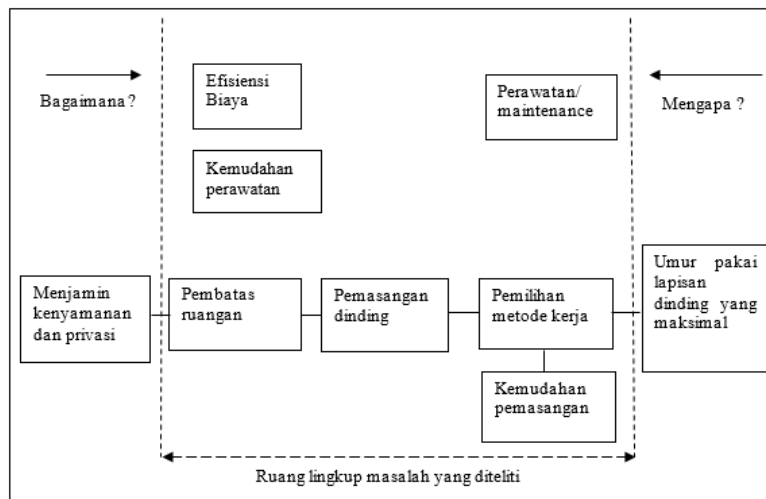


Figure 4. FAST Wall job diagram (in Indonesia)

3.4. Floor Work Function Analysis

Figure 5 explains that the scope of the problem and the critical trajectory from left to right refer to the basic function of closing the floor base. Then there is a secondary function, namely planning alternative components that give rise to a supporting function in the form of material quality strength and the second secondary function is the selection of work methods with a supporting function in the form of ease of installation. The cause function (input) is the selection of the type of material and the output of the basic function is to beautify the room. From the analysis of the scope of the problem and the critical trajectory, it will later give rise to functions that occur simultaneously such as, maintenance/maintenance and goal functions in the form of cost efficiency and technological innovation.

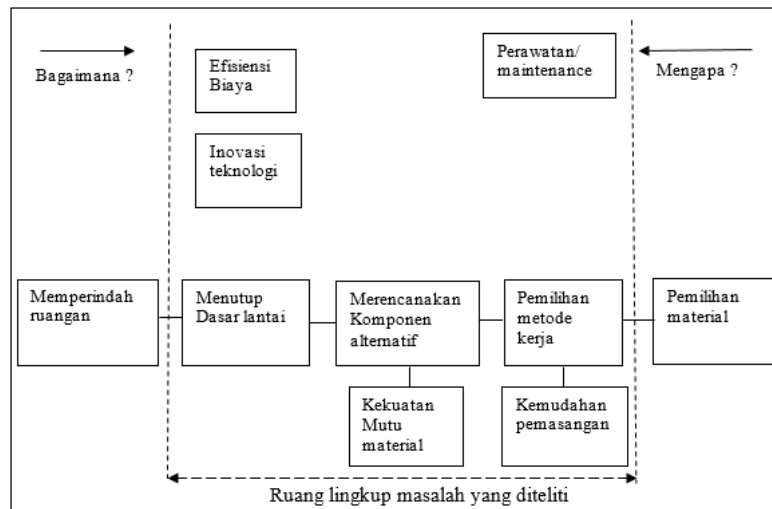


Figure 5. FAST Floor work diagram (in Indonesian)

3.5. Roof Work Function Analysis

In Figure 6, it is explained that the scope of the problem and the critical trajectory from left to right refers to the cost efficiency of the structure with the basic function of calculating the roof load and there are two secondary functions, namely determining the strength of the material quality and replacing it with a more efficient brand. The cause function (input) is the selection of materials and the output resulting from the basic function is for cost efficiency. From the analysis of the scope of the problem and the critical trajectory will cause functions that occur simultaneously, such as the completeness of the building and the purpose function in the form of technological innovation and ease of maintenance.

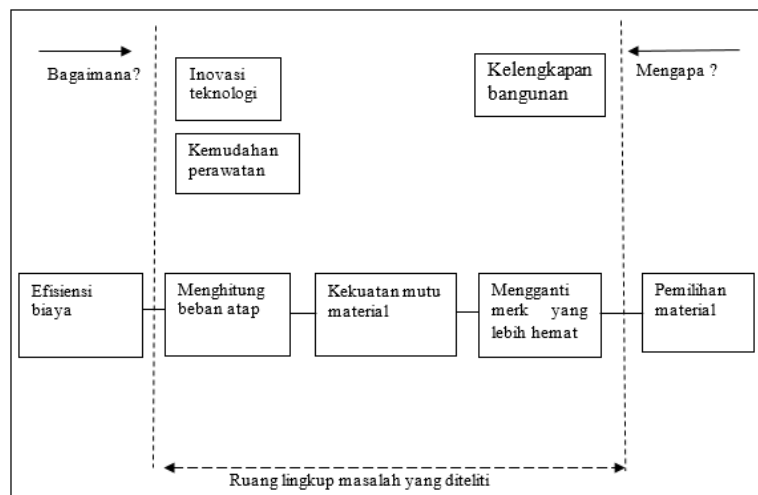


Figure 6. FAST Roof work diagram (in Indonesian)

The results and discussions contain the implementation of the system (if there is a complete photo/ image), system testing, analysis of results, discussions, etc. The results of the study must be in accordance with the research objectives outlined earlier. In this section, it is also necessary to put forward a comparison of research results with previous researchers.

4. Conclusion

Based on the results of the analysis that has been carried out, the following conclusions were obtained:

- 1) Function analysis is the most important stage in *value engineering*. At this stage, a function analysis will be carried out using FAST Diagrams so that the lowest costs are obtained to carry out the main functions, supporting functions and identify costs that can be reduced or eliminated without affecting the quality and quality of the building.
- 2) There are 5 work items that are carried out by function analysis on the Taman Sari Apartment Development project, which are as follows:
 - a. Structural work has the basic function of planning alternative designs and there are two secondary functions, namely material selection and work methods, followed by a neat and comfortable work environment. Then the cause function (input) is to optimize the project resources and the output of that basic function is cost efficiency.
 - b. The work of frames, door leaves and windows with the basic function of planning alternative designs. Then there is the secondary function in the form of material quality strength and the equally important secondary function, namely access in and out of the air and limiting the room. The function of the cause (input) is the selection of materials and the output of the basic fungsi is to provide room access.
 - c. Wall work has a basic function as a room divider. The secondary function required is the installation of walls and the selection of work methods that produce supporting functions in the form of ease of installation. The cause function (input) is to maximize the service life of the wall layer and the output obtained from the basic function is to ensure comfort and privacy.
 - d. Floor work with the basic function of closing the floor base. Then there is a secondary function, namely planning alternative components that give rise to a supporting function in the form of material quality strength and the second secondary function is the selection of work methods with a supporting function in the form of ease of installation. The cause function (input) is the selection of the type of material and the output of the basic function is to beautify the room.
 - e. Roof covering work with the basic function of calculating roof load and there are two secondary functions, namely determining the strength of material quality and replacing it with a more efficient brand. The cause function (input) is the selection of materials and the output resulting from the basic function is for cost efficiency.

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