Aluminum Frame Product Development Using Quality Function Deployment and Value Engineering at PT KSN

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Abstract. PT KSN as an aluminum frame supplier for apartment residential buildings and office buildings faces various demands from consumers. At present there is no standard design for aluminum jamb products, so the modification of the jamb creates an expensive price which makes it difficult for companies to compete with similar manufacturers. The analysis used in this research is Quality Function Deployment (QFD) and Value Engineering (VE). The determination of the technical specifications of the protruding shape and width of the glass groove is carried out using the PT KSN design rules based on the existing gasket type. Some new investment attributes are needed, namely concerning the investment component Dies, the cost of the Design process, CAM programming, and the CAM manufacturing process. Installation of glass with gaskets and without using sealants the installation process is more efficient, easy and safe, the use of aluminum material can be reduced so that production costs are lower and the proposed price offered by consumers is more competitive.

Keywords: Quality Function Deployment, Value Engineering, Aluminum Frame.

1. Introduction

Various types of new demand for the property industry continues to increase, such as new types of materials and designs. Door and window frames are openings in walls/fields that facilitate circulation between spaces. Most door and window frames are made of wood and the rest in their limited use of aluminum, iron and PVC plastic. PT KSN as an aluminum frame supplier for apartment residential buildings and office buildings faces various demands from consumers. At present there is no standard design for aluminum jamb products, so the modification of the jamb creates an expensive price which makes it difficult for companies to compete with similar manufacturers.

Quality Function Deployment (QFD) is an approach to translating consumer needs into the appropriate Technical Attributes (TA) for each product development. The main functions of Quality Function Deployment (QFD) are product development, quality management and analysis of consumer needs [2]. Quality Function Deployment (QFD) has now become a method for increasing global competitiveness [3]. The Quality Function Deployment (QFD) method is a method used to find out firsthand what companies must do to meet consumer needs [1].

The application of the Quality Function Deployment (QFD) method in the process of designing products and services begins with the formation of a product planning matrix [6]. The House of Quality (HOQ) shows the structure to design and form a cycle. The key in building The
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1. Introduction

House of Quality (HOQ) is focused on the needs of consumers, so that the design and development process is more in accordance with what is desired by consumers [5]. The stages of making The House of Quality (HOQ) are as follows [6]: a. Technical response, b. Relationship matrix, c. Technical correlations, d. Technical Matrix (prioritized technical response, target), e. Planning Matrix Technical Matrix.

Value Engineering (VE) is a strategy to increase product value by analyzing product or service functions, determining their value and providing the functions needed to meet the required performance. Value Engineering minimizes waste of materials, time, and product costs while achieving customer requirements [2]. Value Engineering (VE) has several capabilities that can be used as Value Analysis tools. That ability is usually referred to as the main elements of Value Engineering, while the elements are as follows [4]: a. Project selection for Value Engineering Study, b. Pricing for Value, c. Life Cycle Costing, d. Functional Approach, e. Functional Analysis System Technique (FAST), f. Value Engineering Job Plan, g. Creativity, h. Establish and maintain Value Engineering, i. Human Dynamics (habits, barriers and attitudes).

Value Engineering (VE) and Quality Function Deployment (QFD) have different acclimatization. The fundamental objective of Value Engineering (VE) is to reduce operational costs in the principles and processes of supporting an organization while Quality Function Deployment (QFD) concentrates on consumer needs. Integrating these two function-oriented techniques in the decision making process can lead to the development of new products that not only value higher quality by consumers and also reduce production costs, variables that increase price stability/lower product/service cost prices [2].

2. Method and materials

The population in this study were all architects, contractors and applicators. The sample in this study was the architect who designed the facade of the building and the applicator who installed aluminum frames in the field. Literature study is done by studying the tender documents provided by the architect related to the specifications of the window used. After identifying the needs of consumers, the questionnaire was compiled from the results of the interview and the determination of respondents to answer the questionnaire. The analysis was conducted using Quality Function Deployment (QFD) and Value Engineering (VE).

The Quality Function Deployment (QFD) method aims to identify and fulfill consumer desires, while the Value Engineering (VE) method aims to streamline the product development process. QFD and VE were chosen because the QFD method consists of several steps needed ranging from identifying consumers to making consumer desires into measurable technical conditions, so that the technical conditions obtained can be used for the beginning of the development process. Whereas VE is a method that consists of several tools in which these tools will continuously realize a basic function (primary function) and a support function (secondary function) of the tools developed [7].

3. Results and discussion

Based on the results of the preparation of the relationship between technical specifications, the following results are obtained:
Form development of the glass bead & tipping window
Form development of sliding door
Width of glass grove glass
Additional material for window security
Additional of gasket material in each gap
Shipping the product with pallets
Layered protection
Leak resistance up to 200 pascals
Strong against wind pressure up to 200 pascal
Sound reduction up to 20dB

Figure 1. Relationship between technical specifications

If one process characteristic has increased, it will have a strong impact on the other process characteristics. Examples of relationships between technical specifications that have a strong positive relationship are the addition of gasket material in each gap with sound reduction. This is because the more gaps that are covered by the gasket, the system will be more impermeable and have an impact on higher sound reduction performance.
| Product Endurance | Security | Life cycle | Product Protection | Form | Economical |
|-------------------|----------|------------|--------------------|------|------------|
|                   |          |            |                    |      |            |
| Can reduce road noise | There is no sharp edges | Can use 6 + 0.38 + 5 laminated glass | Competitive glass with other manufacturers |      |            |
|                   |          |            |                    |      |            |
| 5 4 4 1 1,5 6 0,061 | 5 3 4 1,33 1,5 6 0,061 | 4 3 4 1,33 1,5 6 0,061 | 4 4 4 1,33 1,5 6 0,061 | 5 2 5 2,5 1,5 6 0,061 | 4 3 1,33 1,5 6 0,053 |

**Figure 2. House of Quality (HOQ)**

Product Development of Laminated Glass Aluminum Frame Frames. After the house of quality is prepared, it will be known the priority of the technical specifications in the development that will be carried out on the design of the existing aluminum jamb system, namely:

a. Development of sliding door protruding forms
b. Development of Glass bead, dead glass and seesaw window
c. Testing wind pressure up to 1200 Pascal
d. Adding gasket material in the profile gap
e. Width of Glass Grove glass
f. Adding window security material
g. Testing leaks of up to 200 Pascal
h. Testing noise noise
i. Layered protection
j. Shipping sills with pallets

The determination of the technical specifications of the protruding shape and width of the glass groove is carried out using the PT KSN design rules based on the existing gasket type. Some new
investment attributes are needed, namely concerning the investment component Dies, the cost of the Design process, CAM programming, and the CAM manufacturing process.

Table 1. Material requirements for after product development

| Item    | Type                   | Size     | Number of units per floor | Number of Tower I units | Aluminum material per unit | Gasket material requirements per unit (meter) |
|---------|------------------------|----------|---------------------------|-------------------------|---------------------------|-----------------------------------------------|
|         |                        | Wide     | High                      |                         |                           | K-28102                                      |
| UAWD-06 | Sliding                | 4430     | 2585                      | 4                       | 128                       | 50.75                                        |
| UAWD-05 | Sliding                | 3830     | 2585                      | 4                       | 128                       | 48.61                                        |
| UAW-07  | Top hung               | 600      | 1050                      | 12                      | 384                       | 5.28                                         |
| UAW-09  | Top hung + fix         | 1050     | 2530                      | 4                       | 128                       | 19.693                                       |
| UAW-10  | Top hung + fix         | 3980     | 2530                      | 4                       | 128                       | 47.036                                       |
| UAW-11  | Top hung + fix         | 4080     | 2530                      | 4                       | 128                       | 47.43                                        |
| UAW-12  | Top hung + fix         | 4530     | 2530                      | 4                       | 128                       | 49.207                                       |
| UAW-13  | Louver + fix           | 1425     | 1200                      | 4                       | 128                       | 19.532                                       |
| UAW-08  | Fix                    | 2580     | 2530                      | 1                       | 32                        | 24.387                                       |
| Total   |                        |          |                           |                         |                           | 57                                           |
|         |                        |          |                           |                         |                           | 141                                          |

In the process of developing this concept, the cost of supporting materials is only the cost of gaskets incurred by the company. This is because the whole glass installation process uses gaskets so that with the development process, the company's costs will be higher, but on the other hand, the costs incurred by the applicator will be lower.

Costs incurred by the company remain the same, namely the cost of material accessories such as crescent locks, camlatch handles, friction stays which are indeed still used and the parts have not changed design.

4. Conclusion
Frame design according to the desires of consumers is needed, especially in the face of the entry of competitors who offer affordable prices and quality products so that companies do develop products using the Quality Function Deployment (QFD) and Value Engineering methods. defined the installation of glass with a gasket and without using sealants the installation process is more efficient, easy and safe, the use of aluminum material can be reduced so that production costs are lower and the proposed price offered by consumers is more competitive.

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