Designing File Organizer Product Design Using the Quality Function Deployment Method (QFD)

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Abstract. In today’s industrial age, many are discovering goods and services to meet the needs of life and activities. Human creativity is required to maintain the fulfillment of life’s requirements in various fields to increase customer satisfaction. To overcome these problems, a study of customer satisfaction using the quality function deployment (QFD) method. The purpose of this study is to determine the desire of consumers through technical characteristics. Brainstorming product specifications include: the main function dimensions are 10 cm x 15 cm x 8 cm, the primary color is black, motifs in the form of lines, decoration in the form of stars, consisting of 3 bulkheads, there are 4 liners on the underside of the surface, the bulkhead material is wood, has an additional function is stationery, has another function color is black, and the dimensions of a different function are 5 cm x 5 cm x 7 cm. Based on the file organizer production process, it was found that there were difficulties in cutting wood. This is because the wood has a rigid structure. The rack is a little complicated so that the operator is less careful in the process of cutting wood.

1. Introduction
Every company is currently experiencing industry competition with each other. Other companies compete to create a condition that is possible to compete for both from outside and outside. Therefore, companies compete to get customer satisfaction with consumer desires [1]. A company must first design a product that will be designed. The design of the product itself consists of a series of sequential activities, therefore method is then referred to as the design process which includes all activities contained in the design. Activities in the design process are called phases. The phases in the design process differ from one another. Each stage consists of several activities called steps in phase [2].

The problem that arises in this industry is the presence of dissatisfaction with customers, therefore companies are required to meet customers [3]. In the manufacturing industry, quality is seen from the product itself, different from the service industry that prioritizes the quality of its services [4].

The main problem that arises most if the technical specifications of the product are not in accordance with the wishes of the customer, when not met then the consumer is not satisfied with the product that is enjoyed [5]. Quality in the product is the ability to meet customer needs [6]. The main goal is to make a product in accordance with the wishes of consumers [7]. The success of a product is measured by the receipt of the product in consumers and directly benefits the company [15]. The main
planning tool used in QFD is *the House of Quality*. *House of Quality* is translating customer desires into the form of design and adjust it to the company that designed the design [14].

### 2. Theoretical Background

High-quality products are the main requirement for the company in the race [11]. Companies must have high innovation in order to realize the desires of consumers [12]. Quality Function Deployment is a technique utilizing to guarantee the quality in each creating items stages, beginning by the plan quality itself [16]. The methods and tools used by the company can create innovations that have product value. The suitable method used is Quality Function Deployment (QFD) because it is related to product design oriented to consumer desires [11]. QFD is one of the ways used to improve the quality of goods and services to realize consumers' desires based on technical characteristics [2]. The primary purpose of QFD is to determine the design criteria, which are the main things in design [8].

Researchs related to product design is titled Redesign Product Multi-Function Tissue Place Using the Quality Function Deployment Method. The object of research is Tissue Holder. Based on the study results, redesigned a multifunctional tissue holder to add value to the product following consumers' wishes, aimed at the needs of the family or household [9].

The design of the product made in this study is a file organizer product. This product is aimed at office needs. A file organizer is a right place for putting office supplies. This product is also given an additional function, which is as stationery. Therefore in this research, a Quality Function Deployment method is used, which is related to product design and development. QFD method has 4 stages, including product planning, design planning, process planning and production planning [13, 17]. The purpose of this study is knowing the desires of consumers in the product file organizer and the steps in the process of designing a file organizer

### 3. Research Methodology

This research is a descriptive research type because this research is used to systematically describe this research. This research also includes action research because it gets a solution that will be applied to the company as a form of improvement [10]. This study aims to design a file organizer product that suits consumers' desires. The steps involved in designing the product are as follows brainstorming, clarifying objectives, establishing function, arrangement of requirements (setting requirements), and determining the characteristics (determining characteristics).

### 4. Result and Discussion

The following are the results of designing a file organizer as follows:

#### 4.1. Specifications of Brainstorming Results

The specifications of the final file organizer brainstorming design are shown in Table 1.

| No. | Product Specifications      | Information    |
|-----|-----------------------------|----------------|
| 1   | Main Function Dimensions    | 10x15x8        |
| 2   | Color                       | Black          |
| 3   | Motif                       | Stripes        |
| 4   | Decoration                  | Star           |
| 5   | Bulkhead Number             | 3              |
| 6   | Number of Stimers           | 4              |
| 7   | Bulk Material               | Wood           |
| 8   | Additional Functions        | Pencil case    |
| 9   | Additional Color Functions  | Black          |
| 10  | Additional Function Dimensions | 5x5x7       |
The final design product file organizer obtained based on brainstorming results can be seen in Figure 1.

**Figure 1.** File organizer product design

### 4.2. Sub Problem

The first stage carried out in the design of Nigel cross is the clarification of the objectives (clarifying objectives) which aims to determine the purpose of designing the product organizer file. The method used in this first stage is the objective tree method (objectives tree method).

The steps that must be taken in making the destination tree are as follows make a list of product design goals. The list of design goals for office stationery shelves is as follows:

- Main function dimensions are 10 cm x 15 cm x 8 cm, black, motive: stripes, decoration: star, consists of 3 bulkheads, there are 4 boilers on the subsurface, the bulkhead material is wood, pencil case, additional function dimensions are 5 cm x 5 cm x 7 cm. Make a goal tree diagram with the aim of showing a systematic relationship of each goal and sub-goal.

The second stage covered is the establishment of functions (establishing functions): regarding the functions needed and the limitations of designing a file organizer product. The method used in this method is the input-output system method using the Black Box principle. The steps in assigning functions are as follows:

- Arrange the overall system function in the form of input-output transformation (Black Box) which shows the process of adding value to input into an output.
- The division of functions into essential sub-functions.

The file organizer product design function is divided into several sub-functions, namely subfunction creation section in the file organizer, the file organizer section is needed as a place to put files, subfunction is making file organizer partition, a file organizer screen is required for delimiter in compiling files, sub-function making additional functions, additional functions are needed to attract consumers because they have other parts, namely office stationery, subfunction, making a file organizer pad, the function of making a file organizer block is needed to hold and support files, product finishing function sub. The product *file organizer* refined using sandpaper to remove the parts that are still coarse and perfect the shape of the product, then do the painting of the organizer and the decoration of additional functions to make it look more attractive.

The third stage is the preparation of needs carried out to compare products *file organizer*, whether the product specifications include demand or wish, by distributing questionnaires to consumers. The steps in preparing the requirements are as follows:

- Determine alternative products to find acceptable solutions, determine the level of generality for production: identify the product attribute performance required by the 5 W (What, Who, Why, Where, When) and H (How) analysis method and determine the performance needs for each attribute.
4.3. Sub Solution

Determination of these characteristics aims to determine the desires and needs of consumers of the product organizer file that is being designed. They are identifying consumer desires in the form of product attributes and determine the relative importance of product attributes.

Table 2. Attribute mode file organizer

| No | Primary | Secondary | Tertiary | Level of Importance |
|----|---------|-----------|----------|---------------------|
|    |         | Main Function | Dimensions  | 10x15x8 | 2 |
|    |         | Color | Black | 3 |
|    |         | Motif | Stripes | 3 |
|    |         | Decoration | Star | 3 |
|    |         | Bulkhead Number | 3 pieces | 3 |
|    |         | Number of Stimers | 4 pieces | 3 |
|    |         | Additional Color | Black | 4 |
|    |         | Additional Functions | 5x5x7 | 3 |
|    |         | Function Dimensions |         |         |
|    | Material | Bulk Material | Wood | 3 |
|    | Function | Additional Functions | Pencil case | 3 |

The steps is evaluate competitor product attributes, describe the matrix of resistance between product attributes and technical characteristics, identify the relationship between product attributes and technical characteristics, identify relevant interactions between engineering characteristics and determine the level of difficulty, the degree of importance, estimated costs, and a description of the target to be achieved.

4.4. The Solution

Alternative generation aims to collect as many alternatives as possible that can be used to solve the problem, to then look for the best option. The option has done using Morphological Charts with the following steps: make a list of functions or goals that are important to the product, for each part or purpose that has been made, a way to achieve it has been stated.

Alternatives obtained from the Morphological Chart will then be evaluated options by re-examining the other options to be selected to produce the best choice. For this step, the method used must be relevant to the objective load. In this case, the method used is the Objective Weight Analysis Method. The stages in this alternative evaluation are make a list of design goals. We are ranking the objectives of designing a list of goals and sub-goals from the high level to the low, define the relative weighting of each attribute, establish implementation parameters for each goal and make calculations and compare the relative utility values of alternative designs.
**Degree of relationship:**

\[ V = \text{Strong relationship level, weight } = 4 \]

\[ v = \text{Moderate level of relationship, weight } = 3 \]

\[ x = \text{Weak relationship level, weight } = 2 \]

\[ X = \text{No connection, weight } = 1 \]

| MODE | ENGINEERING CHARACTERISTICS | Unit | Level of difficulty | Degree of importance (%) | Cost estimation (%) |
|------|-----------------------------|------|--------------------|--------------------------|--------------------|
|      | Wood Weight (kg)            | kg   | 3                  | 15                       | 14                 |
|      | Product Thickness (cm)      | cm   | 4                  | 14                       | 14                 |
|      | Cutting Time (s)            | s    | 3                  | 14                       | 14                 |
|      | The Distance Between the Bulkheads (cm) | cm | 3                  | 14                       | 14                 |
|      | Glue Volume (cm³)           | cm³  | 2                  | 14                       | 14                 |
|      | Paint Spraying Distance (cm) | cm | 3                  | 14                       | 14                 |
|      | Drying time (s)             | s    | 1                  | 10                       | 10                 |

**Consumer perception**

1. **Very good**
2. **Good**
3. **Enough**
4. **Not good**
5. **Not very good**

| Competitor | Cost estimation (%) | Degree of importance (%) |
|------------|---------------------|--------------------------|
| Group 1    | 0-10 = Cheap        | 1 - 10 = Not too important |
| Competitor 1| 10-20 = Moderate   | 11 - 20 = Important      |
| Competitor 2| 20-30 = Very expensive | 21 - 30 = Very important |
| Competitor 3|                      |                          |

**Quality Function Deployment (QFD)**

The main function dimension is 10 cm x 15 cm x 18 cm

The basic color of the file organizer is black

The motive of the file organizer is stripes

The decoration of the file organizer is star

There are 3 bulkheads on the file organizer

There are 4 stoppers on the wet surface

The bulkheads material is wood

Additional function namely a writing instrument

The color of the additional function is black

The additional function dimension is 5 cm x 5 cm x 7 cm

**Figure 2.** Quality Function Deployment (QFD)
Table 3. How to achieve functions or objectives

| No | Function / Purpose            | Acquisition Alternatives                   |
|----|-------------------------------|---------------------------------------------|
| 1  | Main Function Dimensions      | 10x15x8, 10x10x10 and 10x9x10               |
| 2  | Basic Color                   | Black, Blue and White                       |
| 3  | Motif                         | Stripes, Zigzags and Squares               |
| 4  | Decoration                    | Stars, Leaves and Flowers                  |
| 5  | Bulkhead Number               | 3, 2 and 4                                 |
| 6  | Number of Stimers             | 4, 6 and 5                                 |
| 7  | Bulkhead material             | Wood, Plastic and Aluminum                 |
| 8  | Additional Functions          | Stationery, Key Place, and Drink Place      |
| 9  | Additional Color Functions    | Black, Blue and White                       |
| 10 | Additional Function Dimensions| 5x5x7, 2x5x3 and 7x7x5                      |

Table 4. Morphological chart

| No | Characteristics                | How to Reach Functions |
|----|--------------------------------|------------------------|
| 1  | Main Function Dimensions       | 10x15x8                | 10x10x10                | 10x9x10 |
| 2  | Basic Color                    | Black                  | Blue                   | White   |
| 3  | Motif                          | stripes                | Zig Zag                | Boxes   |
| 4  | Decoration                     | Star                   | Leaf                   | Flower   |
| 5  | Bulkhead Number                | 3                      | 2                      | 4       |
| 6  | Number of Stimers              | 4                      | 6                      | 5       |
| 7  | Bulk Material                  | Wood                   | Plastic                | Aluminum |
| 8  | Additional Functions           | Pencil case            | Key Place              | Drink Place |
| 9  | Additional Color Functions     | Black                  | Blue                   | White   |
| 10 | Additional Function Dimensions | 5x5x7                  | 2x5x3                  | 7x7x5   |

Figure 3. Gantt Chart
From the picture above, the most ideal weight is found in W7, which is bulkhead material, while the smallest value is W4, which is decoration. Both alternatives show inequality that is not too far from the matters on each alternative. The alternative chosen is an alternative product I because the Gantt chart shows that alternative Product I has a smaller gap.

The final stage of the design process is used to increase the value of the product for consumers and reduce costs that must be incurred by the manufacturer. It can be done using the Value Engineering Method. The steps in this stage are make a list of product components and identify the functions of each element, determine the value of the function identified, calculate the cost of each component and look for ways to reduce costs without reducing value.

5. Conclusion
Based on the above analysis, the conclusions that can be drawn are product design file organizer using Nigel Cross's 7 steps that produce tree diagrams with 3 different levels, including: The main function dimensions are 10 cm x 15 cm x 8 cm, black, motive: stripes, decoration: star, consists of 3 bulkheads, there are 4 boilers on the subsurface, the bulkhead material is wood, pencil case and additional function dimensions are 5 cm x 5 cm x 7 cm. The steps in the product manufacturing process file organizer can be seen in the Flow Process Chart, starting from making a section file organizer, making bulkhead file organizer, making additional functions, making blocks file organizer and product finishing. Suggestions that can be taken in this study are to be expected solutions that will be applied to companies as a form of improvement.

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