Quality improvement of pillow product using Quality Function Deployment (QFD) methods at PT. XYZ

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Abstract. PT XYZ is a company engaged in the manufacturing of bedding goods. One of the products from this company that will be the object of research is the pillow. The number of disability pillow products that occurred during 2018 amounted to 21.69%, which could cause a decrease in company productivity and the shift of consumers of these companies to competing companies. The method used to improve the quality of pillow products is Quality Function Deployment. In QFD Phase I, consumer desires are translated into technical characteristics. The results of QFD Phase I, show that the highest priority technical characteristics are machine capacity with a difficulty level of 4, importance of 20% and estimated cost of 19%. Determination of product critical parts using QFD Phase II. The results of QFD Phase II show the highest priority of critical parts based on the level of difficulty, degree of importance and estimated cost is durability of 20%, measurement accuracy of 15% and fabric dimensions of 15%.

1. Introduction
The rapid development of technology has led to the rapid changes that have occurred in the business world and in the sleeping equipment industry, which is a cycle of rapid development and is continuously needed by society. Sleep quality is a person's satisfaction with sleep so that someone does not show feelings of tiredness, irritability and anxiety, lethargy and apathy[1]. Therefore, humans need time and good sleeping equipment so that their sleep is comfortable and their health is not disturbed.

The National Sleep Foundation is one of the organizations in the United States that is very focused on researching and discussing every sleep problem in America because many citizens are sleep deprived, and the severity of which often experiences insomnia due to discomfort during sleep both in terms of time, room atmosphere and sleeping equipment. This organization conducted research to find out "How Americans Think About Key Elements of Their Bedrooms and to Determine the Effect of the Bedroom Environment on Sleep". Pillows are needed during sleep to support the head in order to achieve harmony in the body. Pillows appear as one of the products that humans need to meet their needs during rest, especially to provide comfort and support human posture, resulting in quality sleep [2].

The same thing also happened to PT Hilon Sumatra, which continued to innovate its products. PT Hilon Sumatera is a company engaged in the manufacture of bedding, which is located at Jalan Jamin Ginting Km.11 No. 64A Medan-Tuntung District. This company produces various types of bedding
such as pillows, bolsters, carded fiber (dacron crushed), padding and other bedding products. This company operates with a make to stock system, which means that the company produces bedding according to the amount needed by the company. The company also accepts orders based on requests from consumers and large companies such as hotels, hospitals, villas and other lodging facilities.

The average percentage of defective pillow products at PT XYZ in 2018 was 21.69%. This shows the characteristics of pillow products that are not in accordance with consumer desires. This can lead to a decrease in the productivity of the company and can result in a shift of consumers from the company to competing companies. In order for the company to continue to survive and increase sales in the bedding industry market that is increasingly widespread in the market, the company must be able to maintain and improve the quality of the products it produces by identifying every factor that causes defects in bedding products. pillow production so that improvements can be found that can be made to address the causes of the disability. In addition, the company must also be able to listen to the voice of the customer (voice of the customer) so that the company can work to meet customer satisfaction by translating it into technical characteristics. The appropriate method to overcome this problem is the integration approach of Quality Function Deployment (QFD)[3–8].

Previous research conducted by Ginting[9] was related to the use of the Quality Function Deployment (QFD) method. This study succeeded in designing a rubber tapping tool product in Langkat Regency, North Sumatra with the Quality Function Deployment (QFD) method and the Kano Model. The QFD method can determine customer needs and translate these needs into technical characteristics so that each functional area and level of the organization can understand and make improvements to achieve goals.

2. Materials and methods
The object of the research being researched by the researcher was a pillow product manufactured by PT XYZ. This research was conducted starting from the initial process of making pillow products to the final process of making the product.

The right method to solve this problem is the integration approach of Quality Function Deployment (QFD) Phase I and Phase II. Quality Function Deployment (QFD) is a way to improve the quality of goods or services by understanding consumer needs and then linking them with technical provisions to produce goods or services at each stage of the manufacture of goods or services produced [10,11]. Quality Function Deployment is a planning tool used to help businesses focus on the needs of their customers when developing design and manufacturing specifications.

Data collection was carried out by the following steps[12]:

- Sampling technique. The sampling technique used in determining this sample size is total sampling. Total sampling is a sampling technique with the same number of samples as the population. The reason for using total sampling is because the entire population is used as the research sample.
- Open Questionnaire. An open questionnaire contains questions that give respondents the freedom to answer according to their opinion on a particular topic. This questionnaire is a form of questions posed to 27 respondents about the assessment of workers in the pillow-making production process.
- Closed Questionnaire. A closed questionnaire is a question that has been given a choice of answers by the questionnaire maker. Respondents may not answer outside the options provided. This closed questionnaire was obtained from an open questionnaire mode.
- Validity and Reliability Test. The validity test is calculated using the Pearson coefficient formula. Reliability test by calculating the variance of each, the formula used in this test is the Alpha Cronbach method.
3. Results and Discussion

Identification of consumer needs is done through distributing questionnaires to obtain 10 factors of consumer needs for pillow products. The results of the identification of consumer needs can be seen in table 1.

| No | Requirement Variable                                                                 |
|----|---------------------------------------------------------------------------------------|
| 1  | Fiber is the type of foam or foam that best suits the design of pillow products         |
| 2  | 1 kg is the weight of foam or foam that best suits the design of the pillow product     |
| 3  | 3 cm is the thickness of the foam or foam on the pillow that best suits the design of the pillow product |
| 4  | Cotton fabric is the type of fabric that best suits the pillow product design           |
| 5  | White is the color of the fabric that best suits the design of the pillow product       |
| 6  | 55 x 40 cm is the dimension or size of the fabric that best suits the design of the pillow product |
| 7  | 50 x 70 cm is the dimension or size of the pillow that best suits the design of the pillow product |
| 8  | 45 minutes is the length of the process of breaking down raw materials in the required pillow product |
| 9  | 20 minutes is a long process of sewing the fabric on the pillow product needed         |
| 10 | The thickness of the foam is a factor that determines the durability of the product that best suits the design of the pillow product |

The assessment of the level of importance of the attributes was obtained based on the value of the closed questionnaire mode based on the frequency of the most respondents' answers for each attribute. For example, in attribute 1 the highest mode is 5, so the level of importance for attribute 1 is 5. The level of importance of all attributes can be seen in table 2.

| No | Consumer Needs                                                                 | Questionnaire Results | Scale of Measurement | Questionnaire Results |
|----|--------------------------------------------------------------------------------|-----------------------|----------------------|----------------------|
| 1  | Fiber is the type of foam or foam that best suits the design of pillow products  | 12 10 4 0 1          | 5                    |
| 2  | 1 kg is the weight of foam or foam that best suits the design of the pillow product | 12 8 7 0 0          | 5                    |
| 3  | 3 cm is the thickness of the foam or foam on the pillow that best suits the design of the pillow product | 8 9 9 0 1       | 4                    |
| 4  | Cotton fabric is the type of fabric that best suits the pillow product design       | 12 8 7 0 0          | 5                    |
| 5  | White is the color of the fabric that best suits the design of the pillow product  | 7 9 8 3 0           | 4                    |
| 6  | 55 x 40 cm is the dimension or size of the fabric that best suits the design of the pillow product | 10 10 7 0 0      | 4                    |
| 7  | 50 x 70 cm is the dimension or size of the pillow that best suits the design of the pillow product | 10 9 8 0 0     | 5                    |
| 8  | 45 minutes is the length of the process of breaking down raw materials in the required pillow product | 10 12 3 2 0   | 4                    |
| 9  | 20 minutes is a long process of sewing the fabric on the pillow product needed      | 9 11 6 1 0         | 4                    |
| 10 | The thickness of the foam is a factor that determines the durability of the product that best suits the design of the pillow product | 5 3 8 3 8     | 3                    |

Determination of product characteristics based on interviews and discussions with factory production supervisors. The next step is to determine the degree of relationship between the technical characteristics of the product and consumer desires. The level of the relationship in question starts...
from a strong, medium, weak scale, and is not related to the same level. The level of the relationship in question starts from a strong, medium, weak scale, and is not related at all.

The HoQ matrix is based on the data obtained in the previous step. QFD pillow products can be seen in Figure 1.

**Table 3. Critical Part of Pillow Products**

| No | Critical Part |
|----|---------------|
|    |               |

**Figure 1. QFD Phase I Results**

Determination of Critical Part of pillow products can be seen in more detail in table 3.
1 Dimensions of Fabric
2 Strength of Sewing Thread
3 Foam Material Levels
4 Foam Density
5 Durability
6 Accuracy of Cutting

The Phase II HoQ matrix is made based on data that has been obtained in the previous steps. QFD Phase II pillow products can be seen in figure 2.

**Relationship Degree:**
V = Strong positive relationship level, weight = 4
v = Weak positive relationship level, weight = 3
x = Level of negative relationships is weak, weight = 2
X = Strong negative relationship level, weight = 1
O = There is no relationship m = 0

**Figure 2. QFD Phase II Results**
4. Conclusion

The results of the QFD Phase I pillow products show that the characteristics that have the highest difficulty level are engine capacity 4, an importance level of 20% and an estimated cost of 19%. This shows that machine capacity is an important technical characteristic in the manufacture of pillow products because it can result in the product being rejected if a cutting error occurs. These attributes are included in the Phase II QFD. The results of QFD Phase II show that the characteristics that have the highest difficulty level are durability, measurement accuracy, and fabric dimensions. The resistance difficulty level is 4 and the importance level is 20% and the estimated cost is 19%. This shows that there is a critical part that must be considered in the pillow-making process because it can result in a repetition process and even become a reject product.

Acknowledgments

This study was funded by Research Institutions of University of Sumatera Utara, in accordance with project of Research Funding Scheme of Direktorat Riset dan Pengabdian Masyarakat (DRPM) DIKTI 2020.

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