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The Application of Quality Function Deployment to Increase Powder Detergent Product Quality

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ABSTRACT

This research aimed to study about application of Quality Function Deployment (QFD) to increase powder detergent product quality. Recently a new small company develop new detergent product which is branded by the name "ULTRA". It has been introduced to the market but there have been no further steps yet to improve its quality.

This product is compared with 5 other brands which have become a leader market. Customers' votes have important role in this study. Customers' votes translated into technical requirement, then the trade off and priority of action is determined to increase product quality.

From this study, it can be concluded: There are eight attributes about what customers want on the powder detergent product (WHATs). The sequence of weight of customer needs are clean washing (4.69),, not fading the clothes (4.19), perfume/fragrance(4.00),, Price (3.88), Hand friendly attribute (3.69) abundant foam attribute(2.84), weight varies packaging attribute (2.63), and packaging attribute (2.19). If the gap is considered with the best leader market, it can be determined the sequences of prioritized customer requirement are nice fragrance/perfume(21.99%), packaging (17.06%), price(16.00%), weight varies packaging (15.66%), clean washing (15.04%), abundant foam (9.17%), hand friendly (5.07%), and not fading the clothes colour (0.00%)... There are ten technical descriptors (HOWs) and the sequence of prioritized technical descriptors need, from the top is formula (20.9%), active agent (18.6%), caustic soda (17.5%), foaming agent (9.2%), perfume agent (8.4%), packaging material (8.0%), weight varies (5.5%), packaging design (5.5%), filling agent (3.7%), and mixing process (2.8%).

Keywords: QFD, customers' vote, detergent powder quality

1. INTRODUCTION

1.1. Research Background

Product quality plays an important role in a company. A quality product will be sought after by the customers because the customers are satisfied and the product is in accordance with their needs. Customer loyalty will have an impact on company's profits in long term.

Product development process must begin with the desire of customers' (customers' desires). By paying attention to customers' desires, product specifications can meet their expectations and needs, so the product will be succeed. Achieving a synergy can also be obtained by effective communication between individuals or groups. Activities in product development must also be done using a priority so that it will improve the quality of decision making, reducing the time

product required in development (development time). Synergistic step was accommodated on the method of Quality Function Deployment (QFD). Recently a new small company develops new product of powder detergents which is branded "ULTRA". This product has been introduced to the market but there have been no further steps to improve its quality. From some customers who were given samples of products, there are complaints about the lack of detergent products quality. By doing this research, it's expected some improvements of "ULTRA" detergents by considering the customers' vote of this product's quality, so that this product can finally compete with existing products on the market.

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1.2. Problem Definition

From the research background above, it can be defined the research problem is:

- How customers feel with the current product of "ULTRA" powder detergent?
- What is the technical requirement to improve quality of "ULTRA" powder detergent?
- How to improve the quality of "ULTRA" powder detergent?

1.3. Research Objectives

The purposes of this study are as follows:

- 1. Gathering *customers' vote*/customer needs about powder detergent quality
- 2. Do the benchmarking/competitive analysis of current product with the market leader competitors.
- Determine prioritized steps to improve product quality using QFD method

2. THEORETICAL BACKGROUND

QFD is a system to develop new production leads to quality of a product or service which will fulfill customer need. Besides, QFD is also a methodology to translate requirement of customer need into design, and then produces the requirement of customer. The core of QFD is a big matrix connecting customer need (WHATS) and how to design product to fulfill customer need (HOWS).

Cohen (1995) defines QFD is sewer structures method applied indium planning process and product development to specify specification of requirement a product or service indium fulfilling requirement and customer.

QFD was developed in Japan in the late 1960s by Professors Shigeru Mizuno and Yoji Akao. Their purpose was to develop a quality assurance method that would design customer satisfaction into a product before it was manufactured. Previously, quality was controlled during or after manufacturing.

Quality Function Deployment (QFD) is a means of translating customer requirements into the appropriate technical requirements for each stage of product or service

development and production. This approach seeks answers to the following six questions:

- **Customer's vote:** What do our customers need and want?
- **Competitive analysis:** In terms of our customers, how well are we doing relative to our competitors?
- The technical team's vote: What technical measures, relate to our customers' needs?
- **Correlations:** What are the relationships between the customer's vote and the technical team's vote?
- **Technical comparison:** In this comparison, product or service performance compared to the competitors to identify the improvement needed and to guide the design of the product or services.
- **Tradeoffs:** What are the potential technical trades-offs?

Several past research use QFD method to increase product/service quality such as: apartment project at Gargione(1999), Clay Roof-Tile at Retno (2009), Banking Services at Chandra (2007) and multifunction shoes at Wirawan (2005).

3. RESEARCH METHOD Research Stages

Stages of research or the steps undertaken on conducting this research using QFD Steps are as follow:

Quality Function Deployment Step

At first phase using the QFD is identifying requirements of customer and translates it into performance characteristic. At this phase, the House of Quality (HOQ) is made to determine :

3.1 The customer attributes: The left exterior walls of the house represents customer requirements determined by the market research is essentially the Customer's Votes.

3.2 The technical descriptors: The ceiling or second floor of the house contains the technical descriptors describing how the product may achieve its required performance in general terms which is not a specific solution that represents the Designer's Vote.

3.3 Relationships: The interior walls of the house are the relationships between customer attributes and technical descriptors indicating whether there are strong, moderate, or weak relationships.

3.4 Technical matrix: The foundation of the house is the prioritized technical descriptors based on the relationships between customer attributes and technical descriptors.

3.5 Technical correlations: The roof of the house is the technical correlations representing the interrelationship between technical descriptors. This correlation is important to show on what extent the technical descriptors may be mutually supporting and contradictory.

3.6 Planning matrix: On the right side are the prioritized customer requirements or planning matrix providing quantitative market data for each of the customer attributes based on user research, competitive analysis or team assessment.

3.7. Building a house of quality



Picture 1. House of Quality (Chen,J, 2002)

Building a house of quality is not a simple task. Marketing experts, quality team (or QFD team), and technical experts should work collectively to design the house that will ensure better quality for the customers. However, the designing of a good quality house follows seven consecutive steps as mentioned below:

- Step 1: List Customer Requirements (WHATs)
- Step 2: List Technical Descriptors (HOWs)
- Step 3: Develop a Relationship Matrix between WHATs & HOWs
- Step 4: Develop an Interrelationship Matrix Between HOWs.
- Step 5: Competitive Assessments
- Step 6: Develop Prioritized Customer Requirements.
- Step 7: Develop Prioritized Technical Descriptors.

4. RESULT AND DISCUSSION

QFD Implementation through house of quality

Step.1: List customer requirements (WHATs)

Quality Function Deployment starts with a list of customer requirements (WHATs) shows what a customer requires from a particular product or service. A primary requirement customer mav include secondary numerous customer requirements. Although the items on the list customer secondary requirements of represent detail than those on the list of primary customer requirements, they are often not directly actionable by the engineering staff and require extension.

There are eight customers' votes gained from questionnaire. The customers' votes can be display in table 1

No.	Customers' Votes (WHAT)	Weight (scale 1-5)		
1.	Clean washing	4.69		
2.	Abundant foam	2.84		
3.	Not fading the clothes colour	4.19		
4.	Nice fragrance/perfume	4.00		
5.	Hand friendly	3.69		
6.	Price	3.88		
7.	Weight varies packaging	2.63		
8.	Packaging	2.19		

TABLE I CUSTOMERS' VOTES (WHAT)

Clean washing, customers wish the detergent is able to clean the clothes with perfect action. This attribute is pretty important considering its weight on customers' votes (the value is highest between other attribute, that is 4.69).

Not fading the clothes colour, this attribute has value 4.19, is the second sequence. The customers want their clothes colour should not fade when they use the detergent.

Perfume/fragrance, the customers want their clothes having a nice fragrance after washed. This attribute is important, considering its weight value on customers' votes, by 4.00, is the third sequence out of eight attributes.

Price attribute is the fourth attribute in sequence out of eight attributes, by value of 3.88. And then hand friendly attribute, abundant foam attribute, weight varies packaging attribute, and packaging attributes are the fifth, sixth, seventh and eighth attribute in sequence.

Step 2: List Technical Descriptors (HOWs)

Technical descriptors describe how the product may achieve its required performance. From brainstorming with the expert, it can be collected the technical descriptors are:

- 1. Active agent
- 2. Foaming agent
- 3. Caustic soda
- 4. Perfume
- 5. Formula
- 6. Varies of Weight
- 7. Packaging design
- 8. Packaging material
- 9. Filling agent
- 10. Mixing process

Step 3: Develop a Relationship Matrix between WHATs & HOWs

The relationships between customer attributes and technical descriptors indicating whether there are strong, moderate, or weak relationships. Score for strong, moderate, or weak relationships are 9, 3, and 1.

For example, clean washing has strong relationship with active agent technical descriptor. Price attributes has moderate relationship with formula, packaging material and, packaging design. **Step 4: Develop an Interrelationship**

Matrix between HOWs

Interrelationship between technical descriptors is an important correlation to show what level of the technical descriptors

may be mutually supporting or contradictory. The correlation can be described by strong positive correlation, positive correlation, negative correlation, and strong negative correlation.

For example, active agent has negative correlation with foaming agent. Active agent has strong positive correlation with formula.

Step 5: Competitive Assessments

Competitive Assessment is determined by comparing the value level of customer importance, level of customer satisfaction, and competitor. The determination of this goal field is aimed to increase satisfaction performance of Detergent "ULTRA" to the customers.

The customers rank the products with the number "1" to "5". "1" is for the worst and so until "5" is for the very best.

Competitive assessment can be illustrated in figure 2.



Figure 2. Competitive assessment

Here, the best product from the competitors is competitor no. 3, so for the next steps, competitor no. 3 is used as the references on calculating.

Step 6: Develop Prioritized Customer Requirements.

Prioritized customer requirement shows scale or value that needs to be done to improve product quality based on customers' vote weight and multiplied by gap between level satisfactions of current product with competitor product.

The sequence of prioritized customer requirements consider with competitor/best

leader market from the top is nice fragrance/perfume(21.99%), packaging (17.06%), price(16.00%), weight varies packaging (15.66%), clean washing (15.04%), abundant foam (9.17%), hand friendly (5.07%), and not fading the clothes colour (0.00%).

Step 7: Develop Prioritized Technical Descriptors.

Prioritized Technical Descriptors is the phase to look for the sequence of technical descriptors. This priority can be investigated by calculating earlier relative contributing to every technical response to attribute.

The sequence of prioritized technical descriptors need from the top is formula (20.9%), active agent (18.6%), caustic soda (17.5%), foaming agent (9.2%), perfume agent (8.4%), packaging material (8.0%), weight varies (5.5%), packaging design (5.5%), filling agent (3.7%), and mixing process (2.8%).

5. CONCLUSION

Conclusions obtained from this study are:

1. There are eight attributes of what customers want on the powder detergent product (WHATs). The sequence of weight of the customers' needs are clean washing (4.69), not fading the clothes (4.19), perfume/fragrance(4.00),, Price (3.88), Hand friendly attribute (3.69) abundant foam attribute(2.84), weight varies packaging attribute (2.63), and packaging attribute (2.19).

If we consider the gap with the best leader market, we can determine the sequence of prioritized customer requirements that are nice fragrance/perfume(21.99%),

packaging (17.06%), price(16.00%), weight varies packaging (15.66%), clean washing (15.04%), abundant foam (9.17%), hand friendly (5.07%), and not fading the clothes colour (0.00%).

2. There are ten technical descriptors (HOWs): active agent, foaming agent, caustic soda, perfume, formula, varies of weight, packaging design, packaging material, filling agent, and mixing process. 3. The sequence of prioritized technical descriptors need from the top is formula (20.9%), active agent (18.6%), caustic soda (17.5%), foaming agent (9.2%), perfume agent (8.4%), packaging material (8.0%), weight varies (5.5%), packaging design (5.5%), filling agent (3.7%), and mixing process (2.8%).

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