

Redesigning a product based on Voice of Customer

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Abstract: The aim of this study is to improve the available hand dryers in the public restrooms in Iran. Hand dryers are one of the products which could have an important role in the hygienic process in Persian culture. However there is some reluctance in using these devices. In order to explore the reasons, which led to the scarcity of using hand dryers, a Gemba visit performed. Gemba visit is an activity for visiting the users' places of work and lifestyle. Due to the results of the Gemba visit, the problems were explored and the users' needs and wishes were investigated. In order to translate the users' demands into the technical specifications, the Quality Function Deployment (QFD) method was used. Target Costs were also integrated to the QFD matrix to determine the estimated cost of each technical feature. The output of this matrix became the criterion for evaluating alternatives.

Key words: *Voice of Customer, Quality Function Deployment, Gemba, House of Quality, Hand Dryer*

1. Introduction

Every day many products are produced in different countries with various design styles. Most of the time design of a new product is based on the existing products. Therefore it can be said that the design process is often a redesign. The reuse of a certain design can be a good way of developing a new product. As reuse means reusing knowledge, machinery and new technology, redesign can be seen as a good approach for decreasing the costs and improving efficiency. If new requirements have arisen for a new function or attribute, then it is necessary to perform a new study to find a solution for increasing usability of the products. The advantage of redesigning a product is that some parts of the new product is known in advance [7]. Companies redesign their products for several major reasons. One of these reasons is technology changes. Using new technology reduces costs and keeps products viable and competitive. Another reason is that the customers' wants and desires change and this leads to buying certain products. Redesign is a systematic analysis for correcting an existing product's features and market position. Successful redesign requires examining the market as well as investigating users' responses. It is common during redesigning process to challenge underlying assumptions about certain features and how customers value those features as quality [2].

Product quality is an illustration of a users experience with a product evaluated against their expectations during the buying process life cycle [4]. Users are accustomed to the value systems, beliefs and perception processes in the particular cultures in which they grow up. Meeting users' expectation of self-projection is significantly influenced by the using visibility of products. Therefore, the users' need to conform to cultural norms and values when purchasing a product may depend on the using purpose it serves, which may be private or public [10].

Social and cultural variables influence all aspects of user behavior. Cultural values in design are often taken for granted or even viewed as being incontestable. Cultural and social variables become important to designers when they develop product characteristics, especially for a particular user group [9]. Therefore, Method of developing products not only can bring cultural values but also brings market values by creating new markets and sale points for corporations [1].

Today, customers and their views and needs are very important for the companies and designers. They are seeking more innovative ways to understand their consumers' needs and desires [8]. From the designer's perspective, customer needs is usually vague, qualitative, incomplete and sometimes inconsistent. Customers only express what they want. Designers need to figure out how this "what" can be satisfied by a product or service. Designers need detailed, technical-oriented requirements for design. There is an obvious gap between "what" and "how". Customers "what" are usually expressed in customers' own language without any implication of technology and implementations. These customers "what" need to be translated into designers "how", which are quantitative, measurable and actionable technical specifications. Therefore, they can be used by designers to design a product [5]. One of the most important cultural factors in Persian society is hygienic consideration and the main process of this consideration is washing. Washing and drying hands is important in both personal and public life of Iranian people. Therefore Hand dryers are one of the products that could be important for use in Iran. However there is some reluctance in using these devices. It seems that the current hand dryers are not appropriate enough to persuade people to use them. Therefore, an investigation into the reasons for the reluctance of using hand dryers in public places especially public restrooms, seems necessary [11]. In order to recognize the Iranians' reactions, needs and desires about hand dryers that exist in Iranian public restrooms and to find out why people are not willing to use the hand dryers, a Gemba visit performed.

2. Gemba visit study

Gemba is a Japanese term meaning "the actual place" or "the real place" where a product directly reacts with the customer. In lean manufacturing, the idea of Gemba is that the problems are visible and the best improvement ideas will come from going to the Gemba. Gemba visit is an activity for visiting the users' places of work and lifestyle. It can help to understand users' problems and opportunities to enhance the usability of products. The idea is that to be customer-driven. Designer should visit customer's Gemba to understand his problems and opportunities [3].

2.1. Methods

For performing Gemba visit thirty five users, twenty women and fifteen men, were observed and their reactions regarding hand dryers were investigated. They were chosen randomly from among the people who used public restrooms. They were various in gender, age and social class. Then they were questioned regarding the appearance and performance of the dryers. In addition, they were asked to explain their feelings regarding the products by describing their opinions about their experiences of using hand dryers. The study was carried out in six different restrooms: four in Tehran including two toilets of the restaurants and two city public restrooms and two in the highway services. The hand dryers which are in use in these places are mostly imported from China and a few of them were imported from Spain. They are made of white covered metal or low quality stainless steel. They have cubic form and their sizes are about 35x30x25 centimeters. It takes about 50 seconds to two minutes to dry the hands.

2.2. Results

Due to the results of the Gemba visit and interviews, the users' needs and wishes were investigated and the problems were explored. The users did not like hand dryers. These results from users' opinions were classified and summarized to six key words to become comparable statistically. These key words were color, shape, noise, size, material and smell. The results are shown in table 1.

As table 1 shows the public restrooms users believe that the hand dryers are not reliable, safe, hygienic and appealing enough. They are bulky and unattractive in form and color with unpleasant noise. Twenty people out of thirty five interviewees believed that the colors of current hand dryers were not attractive enough to persuade them to use. Also twenty eight of them believed that these white dryers were not visible or recognizable in the white and light environment of restrooms. Table 1 shows that there is more emphasis on unattractive and boring cubic shapes of existing hand dryers. Twenty one of thirty five people complained about the form of these hand dryers and said it was difficult to recognize their using procedures. Twelve of them believe that the loud and harmful noise of these appliances was the main reason of users' reluctance. Eighteen people thought that the large sizes of these dryers made them bulky. Fourteen people mentioned that the material of hand dryers had roles in users' acceptance. They believed that stains in materials of hand dryers in both white metal and stainless steel ones, made their appearances look dirty, which gives a bad feeling to the users. The results of this study show that unpleasant smells in public restrooms, together with the time-consuming functions of the hand dryers, lead people to dispense with using the dryers.

Table1: Collected data from Voice of Customer via Gemba visit

Items	Persons	Voice of Customer via Gemba visit
Colors	20/35	Unattractive
	28/35	White color dryers in restrooms are not visible enough
Shapes	32/35	Unattractive
	21/35	Unrecognizable
Sizes	18/35	Bulky
Material	5/35	Stained dryers are dirty
	9/35	Steel dryers are not safe and reliable
Noise	12/35	Loud and harmful noise and vibration
Smells	26/35	Unpleasant smells in public restrooms and time consuming dryers result in ignoring using them

Due to the results of this study it can be concluded that the most important reasons for reluctance of using hand dryers in public restrooms are sensory reasons which depend on Iranian users' feelings about existing hand dryers, which are not attractive or satisfactory in the attributes of size, shape, color, noise, or even texture.

In order to classify the key words due to users' priorities, they were analyzed statistically by excel software. These results are shown in figure1. According to the collect data from Gemba visit, Unattractiveness of shape of the dryers is the most important item in users' opinions (91.4%). Eighty percent of people who were interviewed found hand dryers invisible in public restrooms because of their white colors. Another reason that led to ignore the using of hand dryers by users is unpleasant smell of public restrooms and time consuming process of drying.

74.3% of users found the environment of using of dryers intolerable. Sixty percent of the public restrooms users pointed out the shape of these hand dryers are not recognizable enough to use. The next item is the unattractiveness of the colors of available hand dryers that 57.1% of users agreed with that as a reason of the reluctance of using hand dryers. 34.3% of users found the noise of hand dryers harmful. 25.7% of users agreed that Hand dryers with steel covers are not safe and reliable to use. The dirty appearance of stained hand dryers is also one of the reasons that make users (14.3%) uncomfortable.

In order to translate these key words to design parameters for redesigning new hand dryer, the Quality Function Deployment was used.

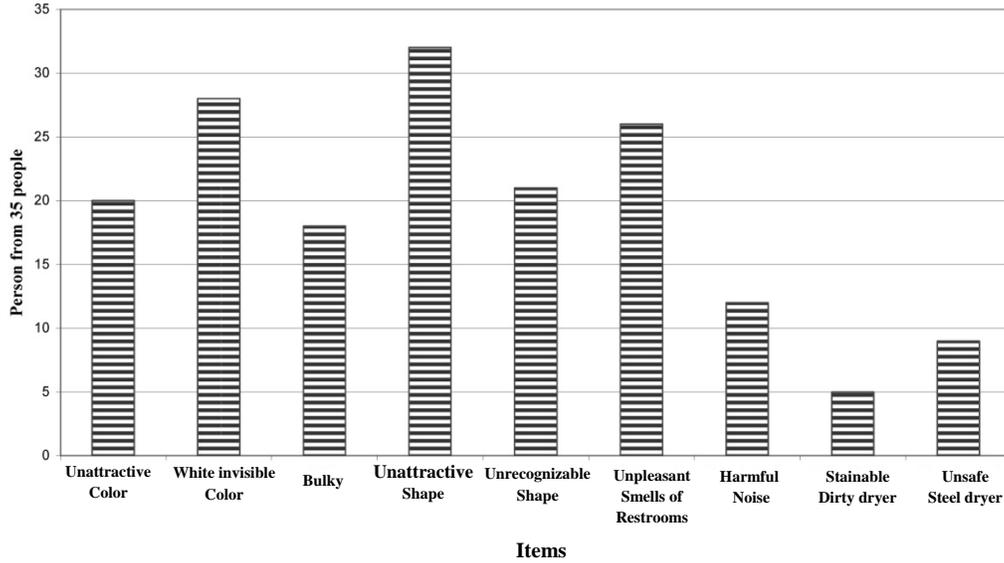


Figure1: Collected data from Voice of Customer via Gemba visit

3. Quality Function Deployment (QFD)

Quality Function Deployment translates customer requirements (voice of customer) into design characteristics (voice of engineer). It establishes customer value using the voice of customer and transforms that value to design, production, and manufacturing process characteristics [5]. QFD is also known by the terms “Customer - driven engineering” and “Matrix product planning”. The whole concept is based on a sequence of operations to translate the voice of customer into the final product or service [6]. QFD method works with a matrix for mapping the voice of customer to the voice of engineer. This matrix is shown in figure2. It is called House of Quality and has typically seven different steps.

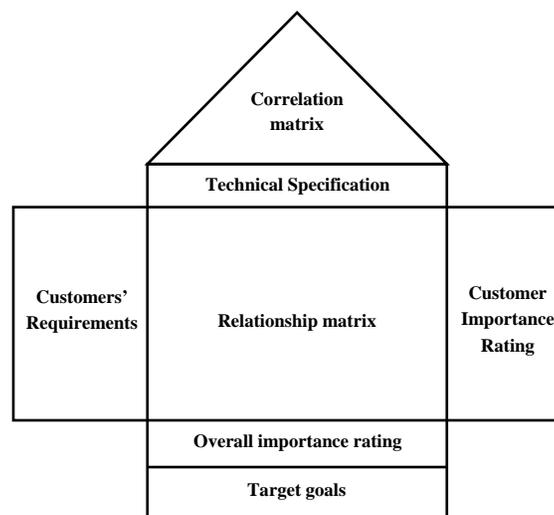


Figure2: Typical matrix of “House of Quality”

Step 1 - Gathering Customers' requirements: It is also known as "Voice of Customer". They are the customers' wants from the product that needs to be developed. They contain customers' wishes, expectations and requirements for the product. The purpose of this activity is to establish a clear understanding of all of the customers' needs, specifically the subjective performance requirements. These subjective performance requirements are called demanded qualities.

Step 2 - Customer importance ratings: Once these customers' requirements are collected, the customer's needs due to the provided numerical ratings to these items would be prioritized in terms of their importance to the customer.

Step 3 - Technical specification: The technical specifications are the engineers' understanding in technical terms due to the customers' want. These data must be quantifiable or measurable.

Step 4 - Relationship matrix: Relationship matrix is used to maintain the relationship between voice of customers (demanded qualities) and design requirements. It is in the center of House of Quality. A weight of 1-3-9 or 1-3-5 is often used to present the relationships.

Step 5 - Correlation matrix: It is the triangular part of the House of Quality (the roof). The correlation matrix is used to identify, which technical specification items support the others or have conflict with each others. Positive correlations help to identify those technical specifications that are closely related and avoid duplication of efforts. Negative correlations present conditions that will probably require trade-offs. These ratings are usually quantified between 2 and -2.

Step 6 - Target values: They are specific technical guidance for what have to be achieved. The goals or values have to be quantified in order to be specific and measurable.

Step 7 - Overall importance ratings: This is the final step of House of Quality. The total number of each column places in this part. The results help to identify critical product requirements and assist in the trade-off decision making process.

3.1. Applying QFD to obtain design parameters of hand dryer

In order to perform QFD process in House of Quality matrix, the users' opinions about available hand dryers were translated to the clear design instructions, which contributed to those six key words. As the House of Quality matrix (figure 3) shows, the users' opinions about the unattractive shape of hand dryers were translated to the attractive shape as a design instruction. Following these steps, a market research carried out in order to identify the best hand dryers as competitors in Iran's market. Then the technical specifications of these hand dryers were investigated and applied in QFD process. The summery of the Benchmark table are shown in table 2. Due to the market research, six different types of hand dryers which are available in Iranian market were chosen for this study. The technical specifications of these hand dryers obtained from their technical catalogues and manuals. These technical

specifications were classified to several items, including; fan speed, material, color, texture, air temperature, sound level, overall dimension, overall weight, electrical power, lockout interval, drying time, airflow rate, air volume, sensor types, form type and prices. They were entered as measurable parameters in House of Quality matrix that could be used for design.

Table2: The summary of Benchmark table

Brand	Image	Country	Price(\$)	Color	Material	Dimension(cm)
Bion		China	79.6	White	Die Cast Aluminum/Epoxy cover	26.3x24.6x24.5
Natus		Korea	107.5	Chromatic	Stainless Steel	36x24x15.6
Magnum UVC		Canada	442	White	Carbon/Stainless Steel/ABS self-extinguishing base	29.2x27x21
Johnson		Italy	80	White/Grey	Stainless Steel/Epoxy cover	30x27x21
Mitsubishi		Japan	750	White	ABS self-extinguishing base	30x22x68.7
Xlerator		United Kingdom	345.5	White/Chromatic	Die Cast Zinc/Epoxy cover	32.2x29x17

At the next step, the relationship between voice of customers and technical specifications were identified. A weight of 1-3-5 was used in this study for presenting the relationships. An orange point was used for showing a strong relationship between a customer attribute and an engineering characteristic. While a black point was used for presenting medium relationship and a black triangle for weak relationship. To find critical product requirements, sum of each column in center part of the House of Quality matrix was calculated. The results as the Engineering Characteristics Importance were shown in the House of Quality matrix. After obtaining the critical engineering characteristics, the target value for each technical detail was investigated from the benchmark table. Each target value was chosen from the best engineering characteristic of the available hand dryers as competitors. These are the values which used as targets in finding sub-solutions and generating alternatives phase in redesign process. The result of target value is presented in figure 3. QFD matrix also shows the users' opinions about the situation of two important competitors in each customer attributes. This analysis helps designer to find out the strength and the weakness of the competitors' products in the market. The two hand dryer that selected as competitors are Johnson and Mitsubishi hand dryer. These dryers were compared in 1 to 5 rating scale. As figure 3 shows Mitsubishi hand dryer has a better rating in most important customer attributes rather than Johnson dryer except its color. The users believed that the white color of the Mitsubishi dryer is invisible in public restrooms environment. Therefore, it can be concluded that the Mitsubishi dryer is the most important competitor of the new hand dryer. In order to be able to compete with this product, its technical specifications should be considered in redesigning the new product.

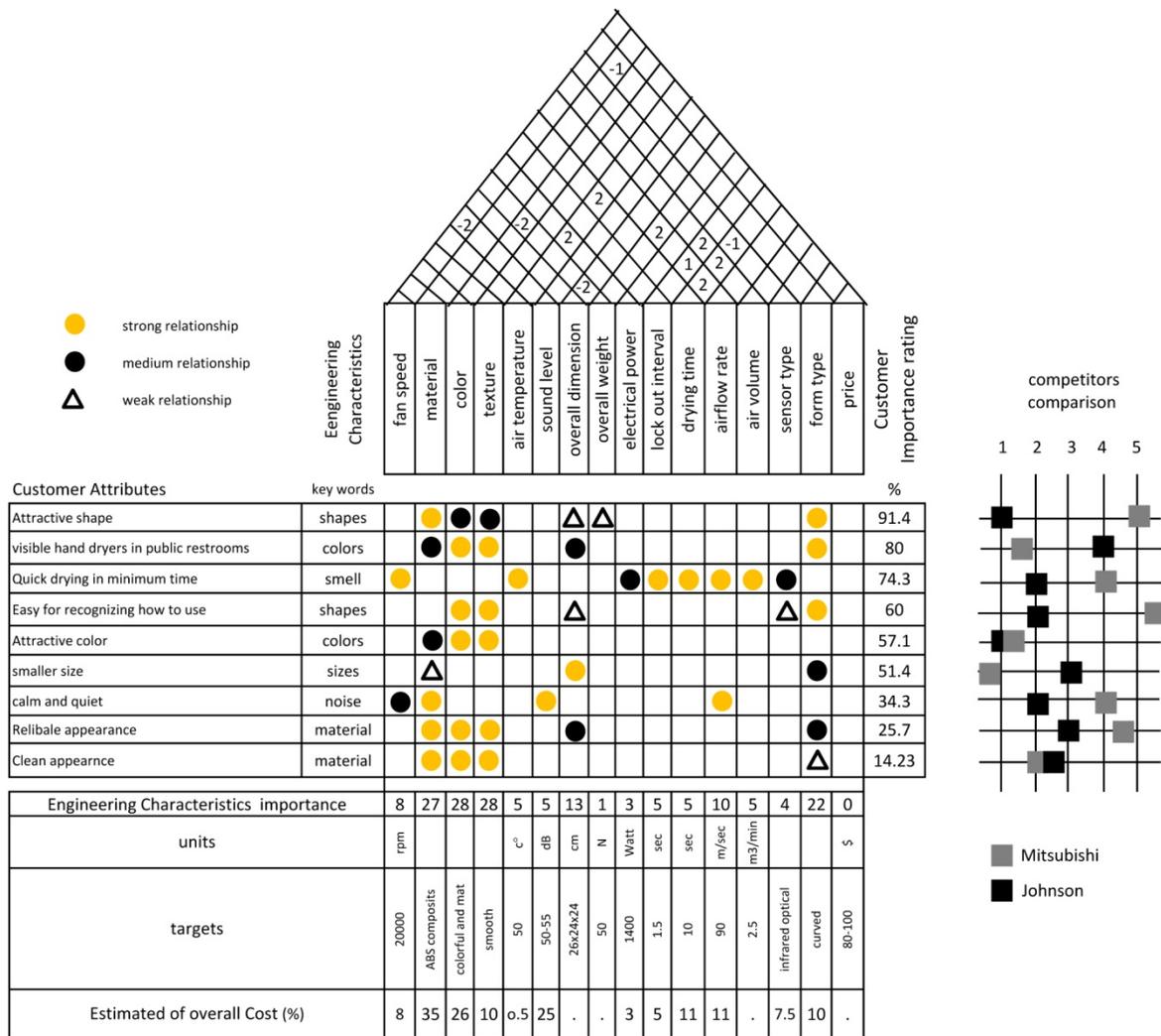


Figure3: House of Quality matrix

Another part of the House of Quality matrix is the estimation of the cost of each technical specification. Figure3 shows these estimations as a percentage of the overall cost of the redesigning process. For instance, selecting of the ABS composites as the material of the new hand dryer has 35% of overall cost. These estimations help designers to consider the cost of each technical specification as a design parameter in redesigning process and use them in Value Engineering phase to increase quality as well as decrease the costs.

4. Discussion

As the results of Gemba visit show, the majority of people who were interviewed, believed that shape of the current hand dryers were unattractive. They also said that due to the inappropriate color of the hand dryers, they were hardly visible in the public restrooms. As it can be seen these items are related to appearance of the hand dryers. Therefore, it can be said that the appearance of the product is very important to the users. Obviously form of hand dryer is one the most important factors that can influence the attractiveness of the shape of it. The type of material that would be

used for manufacturing the product is also has an important role. This relation can be found in the QFD matrix. Attractive shape as the most important customer attribute has strong relationships with product material and its form. While it has medium relationships with dryer color and texture and weak relation with overall dimension and weight. There is no relation between attractiveness of shape and other technical items (figure 3). The second important item in customer attribute list is visibility of a hand dryer in the public restrooms. This item has obviously strong relationship with color, texture and the form of the dryer. There is also a medium relation between a visible hand dryer and its material and overall dimension.

According to the QFD matrix (Figure 3), color and texture of the hand dryers with score 28 are the most important engineering characteristics. The next important specification is the material with score 27. The form of hand dryers is the third major parameter (score 22). This shows that the factors, which have a strong relation with the most important customers' attribute, obtained the highest score between engineering characteristics. Therefore it can be concluded that these critical engineering characteristics have the significant role in determining the major voice of customers and designers should give a specific consideration to these items.

In the other hand the price of the hand dryers with zero score has not any competitive value in the matrix. This is due to the type of the product. This product is available in public restrooms and the end user is not responsible for buying it and paying for it. Therefore, the price of the product is not important for the user.

5. Conclusion

Redesign is one of the common methods of developing products in industrial world. In order to redesign a product, there is a need to find the fallibility of current products and obtain the design parameters. In this study the fallibility parameters of hand dryers were identified by Gemba visit method. Then design parameters were obtained via QFD method. This study showed that one of the advantages of redesigning a product is that the product is already exists and the user has a good experience of using process. Therefore, investigating the weaknesses of the product in accurate details is easily possible. QFD as a powerful tool helps designers to translate the users' wants and desire to design parameters. It also rates the situation of competitors in the market, due to the voice of customer. Therefore, the strengths and weaknesses of each product would be identified.

In this study the effect of applying each technical specification on the overall cost of final product was determined, which is very useful for generating and evaluating alternatives. Employing this method provided the opportunity of increasing the quality without increasing the overall cost of the product.

As a result of present study it can be concluded that applying QFD for redesigning a product is effectively valuable to change an existing product to a high quality one.

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