Product Development with Quality Function Deployment (QFD) : A Literature Review

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Abstract. Quality Function Deployment (QFD) is one method for developing customer-oriented products. QFD is a planning process that helps the organization plan to implement various technical support tools effectively and complement each other to prioritize each problem. House of Quality (HOQ) is a tool from QFD that is used to determine design boundaries, shows the relationship between respondent needs and the matrix to satisfy the needs of respondents and illustrates the focus of the design team to produce quality products. The paper’s purpose is to review the QFD literature based on references that have been collected about the history of the development of the QFD method and the application of QFD in product design and development. Planning for process quality is a very important technique for managing the quality of the product during the product development process. Done to expand processes and adequate process capabilities aimed at producing products. Since Japanese academics and industry began 3 decades more than have passed to formalize QFD techniques in 1960 and 1970. Because of the effectiveness in quality management and product expend, QFD applications have been widely used.

1. Introduction

Quality Function Deployment is method for developing customer-oriented products. QFD is a planning process that helps the organization plan to implement various technical support tools effectively and complement each other to prioritize each problem. QFD is a method for improving the products and services’ quality by understanding consumers’ needs and then linking those needs with technical characteristics to produce products or services in each process of making products and services [1].

Quality Function Deployment can be explained as a process to specify customer wants and needs and these needs are translated into the technical characteristics, so that every functional field and organizational level can understand with make improvements to achieve goals. In addition, the application of the QFD can guarantee that information about the needs and desires of consumers received at the early. The planning process stages are applied at all steps of the product or service life cycle. The use of QFD will help gain a competitive advantage through the manufacturing process customer satisfaction can be increased through the quality attributes of products and services [2].

House of Quality (HOQ) is a tool from QFD which is used to determine design boundaries, shows the relationship between respondent needs and the matrix to satisfy the needs of respondents and illustrates the focus of the design team to produce quality products. The products’ technical characteristics which have the highest score indicate the technical characteristics are the focus of
improvement facing the company, assembly process’ attribute have the highest value is the products that must be corrected to overcome the problems that often arise. The planning of process quality is a very important technique for managing product quality during the process of product development which aims to develop processes with useful process capabilities to produce products [3].

The purpose of this paper is to review the QFD literature based on references that have been collected about the history of the development of QFD with the application of QFD for product design and development.

2. Theoretical Background

2.1. History of Quality Function Deployment (QFD)

It was introduced in Japan and developed at Mitsubishi’s Kobe Shipyard Kobe in 1972 [4]. In 1960, Quality Improvement with Quality Control had a distinctive manufacturing taste in the 1960 and 1970, Joji Akao with others went for working to improve the design process in Japan, it was high quality when new products were introduced to the factory. The process to increase design was called QFD. Since 1975 to 1995, this method was already integrated with the others repair methods to produce opportunities for product developers [5]. After QFD development in Japan, Akao, and Kogure published the ‘Dep Implementation of quality and CQWC functions in Japan, October 1983 due to Quality Progress, as a marker entry of QFD into the US [6].

2.2. Functional Fields of QFD

Quality Function Deployment is a technique utilizing to guarantee the quality in each creating items stages, beginning by the plan quality itself [24]. The process of QFD is activities’ consequence to process customer values and make these values are able to make product design or services. This process has basic steps: To identify the customers; To identify that customers needs; and The way to fulfill what the customer wants. The Quality Function Deployment process defines customer values so that the voice of the customer can drive the design of a product and service. Process of QFD implicates the cross-functional team that functions to set customers and what their want. Afterthat, the team decides the how - mechanism for fulfilling customer's desires. Finally, That team determined a relationship between 'what' with 'how' and assigned weight values to all of them using home quality (HOQ) [7]. The QFD approach may likewise be extremely useful for scholastics intending to approve recuperation viability in the administration business [25].

Quality Function Deployment is a effectual and reliable tool in quality planning [8]. It is a structured methodology for translating customer wish into product design or engineering characteristics, further into part characteristics, process plans, as well as production requirements related to the manufacturer. There are 4 phases: product planning, part placement, process planning, and production planning [9]. This is a complicated and time-consuming advance in developing charts in QFD. QFD is very useful, but not an easy tool to use. [10]. Various improvement efforts have been made in aspects in the last decade, namely:

- The way to handle subjective and ambiguous data in QFDS data like covering the customer's voice (VOC), the relationship between technical characteristics (EC) and VOC, correlation between EC and EC priorities. The researchers have attempted to combine quantitative tools, artificial neural networks (ANN) with fuzzy set theory to QFD overcome problem [11].
- How to facilitate the application of QFD for all of the product development phases by integrating QFD with other methods. QFD with the concept selection method for selecting product concepts for the construct development phase. As multiplication allows the team to evaluate concepts using the Pugh, give technical importance rating using QFD [12].
3. Research Methodology
The method used in this paper is a literature review study. The writing of this review literature is based on the best international and national scale journals. Search for journals by collecting caring themes that are the application of Quality Function Deployment. The journals are collected through the google scholar databases and Science Direct websites.

4. Result
Rosnani Ginting [14] redesigned Tissue Place design. A product is said to be good if it successfully meets the needs of consumers. Therefore, a review of the product will be better if it is adjusted to the needs of consumers. One method that moves from the needs of consumers is the QFD. The quality control of a product is based on the wants and needs of consumers in this QFD. QFD has advantages because by paying attention to the desires of consumers, so the products produced will truly satisfy consumers.
Hamidullah R. Akbar et al [15] developed dashboard products on cars, the information gleaned from the survey customer requirements’ survey, technical descriptions, and relative importance was used to build HOQ for the dashboard of the car. The concept-making process is based on the results of the HOQ. The chart of Pugh is used for the selection of the car A / C blower system’s concept and the versatile glass holder on the dashboard of the car.

Shamsuddin Ahmed [16] used QFD as a method to integrate customer wants and needs into the production process and to increase the demand for tempered glass produced by SAT Glass manufacturing company. Added additional functional features, such as after-sales service and product customization strategies that will attract new customers to the company and increase customer loyalty, in order to increase their competitiveness.

Rosnani Ginting, et, al [17] improved the quality of crumb rubber products Type SIR 20 according to the needs of respondents using the QFD method by identifying product design attributes and knowing the priority of the importance of the technical characteristics of the product. QFD analysis is utilized by the design team to obtain data on market expectations that will be compared with a company’s technical potential to carry out the process of production. The results of QFD phase 1 processing obtained by crumb rubber products Type SIR 20 attributes that have the highest relative weight is variable water content in rubber affects the drying time with a value of 14.7864%. The technical characteristics of crumb rubber products Type SIR 20 with the highest degree of importance, degree of difficulty, and estimated cost are production costs with a value of 21%. Crumb rubber products Type SIR 20 with the highest degree of importance, level of difficulty, and estimated cost is the cost of production with a value of 21%. Crumb Rubber Type SIR 20 products with the highest degree of importance, degree of difficulty, and estimated cost are the production costs with a value of 21%. This can be the company’s first priority as a reference for improving the quality of Crumb Rubber Type SIR 20 products.

Rosnani, et, al [18] solved the company's problem on the company's inability to meet customer demands due to the amount of time needed to assemble spring bed products. Therefore, an analysis is needed to reduce assembly time and reduce unit costs. The problem in this study was identified by using the quality function deployment (QFD) method. QFD is a well-known methodology for the design and development of customer-oriented products.

Sukhlal Mujalda [19] applied QFD in improving the design of row house buildings located in urban areas of the Indore city in India. The construction area is around 1,000 square feet. A estimated budget to this project is about Rs 3,500,000.00. Each unit has a basic layout including 2 bedrooms, 1 master bedroom, 3 bathrooms, 1 living room, kitchen, laundry, and balcony. The developers of this project are small owners who operate real estate development and construction companies.

Sukhlal Mujalda [20] implemented QFD for improving design of the main bathroom in the urban area in Indian city of Indore. The construction area is around 14 x 6. The main bathroom unit is designed to ascertaining the user's aesthetic needs, basic needs, and the current generation’s expectations. Every effort was made to develop a model of implementing modular quality functions for the master bathroom with the help of technical and customers assessments. A goal of modifying a bathroom using the QFD application is able to be achieved in a real estate project. The QFD application is an invaluable and flexible tool from the design stage and in development for the master bathroom’s interior.

Chatree Homkhiew [21] implemented QFD in the development of a new plywood wardrobe prototype processing to increase customer satisfaction. Customer requests are changed to House of Quality. Newly designed and developed products vary in shape, pattern, color, function and quality of the material used. Product satisfaction is evaluated by customers by grouping various product user groups and sales agent stores. The results revealed that the average value of satisfaction for all types of new products increased from the current product, from the level of 2.71 to 4.08 (54.87%). The hypothesis of average customer satisfaction between current and new designs was found to be significantly increased with respect to the QFD approach.
Edy Rustam Aji [22] QFD method by taking into account the priority targets of the technical characteristics of the learning table lamp products from the successful QFD analysis obtained 10 technical responses namely, the results of design and manufacturing of study table lamps with length 23 cm, width 20 cm, and height 12.5 cm. For features available on this product, such as: adding a sleep lamp, a small fan, office stationery, an LED clock, and can be as a power bank. The lamp can be lit without any electricity and can automatically turn off step by step to choose usage.

Bukhari Imron [23] uses the QFD to accommodate the needs of consumers for a product, it is expected to create a charger that utilizes solar energy as a charger. As an electronic device, mobile phones need a battery charger. Solar energy can be used to recharge the cell phone batteries by converting them to electricity. A research is needed to be able to utilize solar energy so that it can be used as a useful alternative energy.

5. Discussion
The method that can be used to produce products according to consumer tastes and desires is QFD. Through QFD, it can help determine which products and services according to what customers want through product and service attributes. QFD has a degree of importance, level of difficulty, and cost estimates that can be the focus of improvement.

6. Conclusion
More than three decades have passed since Japanese academics and industry began to formalize QFD techniques in 1960 and 1970. Because of its effectiveness in quality management and product development, many QFD studies and applications have been carried out. Through a search of various sources, it presents a brief review of the historical development of QFD and a categorical analysis of the functional areas of QFD, applied industries and methodological development to facilitate reference references from QFD researchers and practitioners. Updating this literature review both in terms of proper categorization and completeness of scope in the future to better serve the world of QFD.

7. References
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