APPLICATION OF QUALITY FUNCTION DEPLOYMENT IN PRODUCT DEVELOPMENT.

P.S. Rajeswaran\textsuperscript{1} and R. Gandhinathan\textsuperscript{2}

Abstract: Quality function deployment (QFD) help to realize significant reduction in product design cost and development time. The QFD process includes ranking customer preferences, rating the competitors, and parts deployment for the new or existing product. This study is carried out to understand the QFD concepts and implement this concept into the redesign of Monoblock submersible pump according to the customer requirement.

Keywords: QFD, Voice of customer, Product Competitive Analysis, Monoblock submersible pump.

1. INTRODUCTION

Quality Function Deployment (QFD) was introduced by Mitsubishi and has been widely used in Japan by Toyota, in the late 1970s, and more recently in the United States and other leading industrial countries. One of its founders, Dr. Yoji Akao, defined the concept as follows: “QFD provides specific methods for guaranteeing quality at each stage of the product development process, starting with design. In other words, it is a method for introducing quality right from design stage to satisfy the customer and to transform customer requirements into design objectives and key points that will be required to ensure quality at production stage”. It was developed to bring this personal interface to modern manufacturing and business. In today’s industrial society, where the growing distance between producers and users is a concern, QFD links the needs of the customer (end user) with design, development, engineering, manufacturing, and service functions. QFD is a comprehensive quality system that systematically links the needs of the customer with various business functions and organizational processes, such as marketing, design, quality, production, manufacturing, sales, etc., aligning the entire company toward achieving a common goal. It does so by seeking both spoken and unspoken needs, identifying positive quality and business opportunities, and translating these into actions and designs by using transparent analytic and prioritization methods, empowering organizations to exceed normal expectations and provide a level of unanticipated excitement that generates value. The QFD methodology can be used for both tangible products and non-tangible services, including manufactured goods, service industry, software products, IT projects, business process development, government, healthcare, environmental initiatives, and many other applications. QFD understanding customer requirements, maximizing positive quality that adds value,

\textsuperscript{1} Department of Production Engineering, PSG College of Technology, CBE 641004, India.  
\textit{E-mail: rohit4035@yahoo.co.in}

\textsuperscript{2} Department of Production Engineering, PSG College of Technology, CBE 641004 India.
comprehensive quality system for customer satisfaction. This technique is applied in the product monoblock submersion pump model 7.5 SMH (12,13), by using the customer needs, evaluating the competitor, identifying the technical features and apply to redesign of the product.

2. LITERATURE SURVEY

Literature provides numerous publications on quality function deployment (QFD). In the following sections some of these are presented from previous work of researchers who have attempted application of QFD in product design phase.

Govers (1996) has mentioned that Quality Function Deployment (QFD) is not just a tool it is a process for product as well as production process development based on concept of Company Wide Quality Control. Success for firm is the cross functional management approach. QFD means translating customer requirement into product concepts. The design requirements WHAT’s serve as input to establish the component characteristics HOW’s of the product design. The house of quality methodology is used to show the relationship between the WHAT’s and HOW’s. QFD develop users based on common sense and effective information. Thus the author concluded that QFD can be implemented at least in a system oriented company.

Govers (2001) has mentioned that QFD is a method of continuous product improvement emphasizing the impact of organizational learning on innovation. A company that struggles with the quality performance at the aimed level has to stress basic quality techniques. Policy deployment and process management these process together create the transparency, focus and cohesion required to motivate concerted effort. For starting QFD the scope of project has to establish and they should be communicated and that has to approve by management. The general resistances to implement QFD approach are lack of time, short term thinking, and lack of support. Thus the author concluded that firms need for sound evaluation and open minded communication, within the organization to stimulate organizational learning.

Carnevalli and Miguel (2008) have mentioned literature survey on quality function deployment produced between 2002 and 2006. They done conceptual and empirical research, they found difficulties in its application like interpreting the customer voice, correlations between quality demanded and quality characteristics. Here the affinity diagram and tree diagram permits hierarchical groupings and organizing information on the scope of the studies, definitions, benefits, difficulties, recommendations and prerequisites on the use of QFD. QFD method use technique like fuzzy logic, analytic hierarchy process, analytic network process and artificial neural nets. Thus the author concluded that the most quality matrix problem solving analysis and priority issues are perform by fuzzy logic technique.

Chan and wu (2002) have mentioned that QFD is a technique employed to translate customer voice into technical requirement. They conducted analysis on QFD’s functional fields, applied industries and methodological development. Fuzzy logic method is used to deal with subjectivity and ambiguity of evaluation on “WHAT’s” and “HOW’s”. They suggested quantitative methods to use in QFD to improve its reliability and objectiveness. Thus these authors have extensively survived the literature and appraised that many more such survey are necessary to update the knowledge on QFD.

Vairaktarakis (1999) has mentioned that QFD has helped organization to realize the reduction in product design costs and development time. QFD charts provide marketing insights and identify
winning marketing strategies of competitors. They develop and solve optimization models for the identification of consensus rankings and ratings, that take into account the priorities and perceptions of all the customers in a target market. Based on consensus rankings, they identify a parts mix for the new/improved product that satisfies a budget constraint and performance expectations of customers. Thus the authors concluded that extending the methodology to incorporate the impact of pricing and demand elasticity on product design.

3. METHODOLOGY

The methodology followed to carry out this project is shown in Fig. 1. As indicated, the project has started by studying the literature on Quality function deployment. An extensive literature survey has been carried out. Based on this literature collection, lead time analysis for product have been analyzed.

The identified product is Submersible monoblock pump, manufacture by PSG Industrial Institute, Coimbatore. Model (7.5 SMH 12, 13). According to this methodology the project work has to be done. This product have more customer complaint like overloading problem, impeller rust, coil burning, impeller damage etc. these problem has to be solved by developing the Qfd.

![Fig. 1: Methodology followed During the Quality Function Deployment (QFD) for Product](image-url)
4. **PRODUCT**

The product is Submersible monoblock pump Model (7.5 SMH 12, 13).

**Product Specification:**

<table>
<thead>
<tr>
<th>HP</th>
<th>NO OF TYPES</th>
<th>HEAD RANGE (FEET)</th>
<th>OUTPUT RANGE (LPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
<td>7</td>
<td>197-46</td>
<td>1505-425</td>
</tr>
</tbody>
</table>

![Submersible Monoblock Pump](image)

**Fig. 2: Submersible Monoblock Pump**

**Features:**

- No risk of theft / damage as the pump is kept inside the sump/well
- Trouble free operation with longer life
- Hardwearing water lubricated bushes
- Highly durable water cooled rewind able motor
- Easy dismantled and repaired.
- Wide voltage range motor design.

**Application:**

Agriculture, Industrial and Rural water supply, Domestic, Gardens, Irrigations, Drip and Sprinkler Irrigation.

**Pump:**

A pump is a device used to move fluids, such as gases, liquid or slurries. One common misconception about pumps is the thought that they create pressure. Pumps alone do not create pressure; they only displace fluid, causing a flow. Adding resistance to flow causes pressure.

**Centrifugal Pump:**

A centrifugal pump is a rotodynamic pump that uses a rotating impeller to increase the pressure and flow rate of a fluid. Centrifugal pumps are the most common type of pump used to move liquids through a piping system. The fluid enters the pump impeller along or near to the rotating axis and is
accelerated by the impeller, flowing radially outward or axially into a diffuser or volute chamber, from where it exits into the downstream piping system. Centrifugal pumps are typically used for large discharge through smaller heads.

**Working:**

A centrifugal pump works by the conversion of the rotational kinetic energy, typically from an electric motor or turbine, to an increased static fluid pressure. This action is described by Bernoulli’s principle.

The rotation of the pump impeller imparts kinetic energy to the fluid as it is drawn in from the impeller eye (centre) and is forced outward through the impeller vanes to the periphery.

As the fluid exits the impeller, the fluid kinetic energy (velocity) is then converted to (static) pressure due to the change in area the fluid experiences in the volute section.

Typically the volute shape of the pump casing (increasing in volume), or the diffuser vanes (which serve to slow the fluid, converting to kinetic energy in to flow work) are responsible for the energy conversion.

The energy conversion results in an increased pressure on the downstream side of the pump, causing flow.

**Components of A Centrifugal Pump**

The most important component parts are:

- Impeller
- Pump casing
- Suction pipe
- Delivery pipe

![Figure 3: Components of Centrifugal Pump](image)
5. CUSTOMER INTERVIEW

The customer review where conducted with various people. There are twenty customer were interviewed and recorded. Here Like/Dislike method used to conduct interview.

Like/Dislike Method:

The Fig. 4 is a form that can be used to record the interviews. There is basic header information related to the project and the interview subject. The form itself has three columns. the first column is used to record any particular question that sparks a customer response. The middle column is the actual customer statements. The last column is the conversion of this actual customer statement into a succinct noun-verb-adverb-form, using the same words as the subject stated as recorded in the second column.

![Fig. 4: Customer Interview Data for the Submersible Monoblock Pump](image)

The like/dislike method has general row categories to record the customer statements, if the customer likes the way a need is implemented, it is recorded in “likes” rows. If the customer does not like how a need is implemented, it is recorded in the “Dislikes” rows. This structure permits immediate understanding of what needs to be focused on when redesigning a product.

6. PRODUCT COMPETITIVE ANALYSIS

The competitor analysis was done between five manufactures in order to identify the rating. By using this analysis, it is easy, to identify were our product stands. By using certain attributes the competitor analysis was developed.
In the Fig. 5. The competitor were mentioned. These manufacturers are our competitors. The data mentioned above are collected by interviewing various traders, customers etc. the above mentioned attributes are to be rectified by developing QFD and analyzing by using various soft =wares.

7. FURTHER WORK

To identify technical features.
Feasibility analysis.
Apply QFD tool for product development
Design and analyzing the product.

7. CONCLUSION

In the present competitive and high volatile market scenario, in order to meet the dynamic demands of the customers, the organizations need to achieve QFD in their design pattern. In order to reduce developing time and product cost QFD play an important role. The design team should use this technique to develop technical feasibility and to identity the customer needs.

REFERENCE


Application of Quality Function Deployment in Product Development


