



EFFECTIVE TECHNIQUES ON QFD APPROACH AND HOQ USING FUZZY LOGIC

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ABSTRACT

Nowadays in the modern world effective customer services is needed. Many chain management literatures and logistics describe the customer service management strategic, issues of companies, customer satisfaction and gain of market shares. The main aim of this paper is to focus on the original approaches of customer service management and new product development services adopted by quality function deployment (QFD). This methodology has introduced many successful customer services particularly, the main issue of the deployment of the house of quality (HOQ), logistics process improvement and customer satisfaction. The ill-defined nature of the qualitative linguistic judgement deals also with the fuzzy logic.

Key words: Logistics services, fuzzy QFD, HOQ, customer service management.

I. INTRODUCTION

An organisation is successful when it has a varied and is competitive in its environment. It has to be customer-oriented keeping in mind the various needs of the customers satisfying and encouraging them with new products and giving good services. The organisation has to keep in mind the various subjects like customer's economic, social and cultural needs and keep changing their approaches accordingly.

The organisation has to deal with managing and quality techniques in production, marketing and sales areas according to QFD techniques. QFD techniques is a study of the market based on customer's demand and how to change their needs. It also tells the customer's requirement of new and revised needs and what the organisation has done to meet the needs. So, in short QFD helps in understanding the customer's needs by the marketing people.

The three main goals of QFD are,

1. To give preference to spoken & unspoken customer's needs and demand.
2. To priorities these wants into technical methods and special needs.
3. To satisfy the customer by delivering a quality product and to fulfil their needs.

a) The four phases of traditional QFD:

Companies have adopted these methods for introducing a product and for quality developments. The quality phases are:

1. **Planning** - Planning of product requires a lot of documents regarding customer's requirements warranty data, other competition from industries, technical ability to meet the demand etc.

2. **Designing** - Designing the products requires the innovative and creativity ideas from the team members.
3. **Work flow** - A flowchart and target values of the production and execution of the work requires planning of the process.
4. **Process** - Process control requires the performance indicators of the team. The production planning, schedule and training programme are needed for the team. It also deals with risk factors and methods taken to prevent failures etc.

II. QFD AND THE HOUSE OF QUALITY (HOQ):

A four phase approach is required to document the product and each phase consists of “whats” and “Hows”. At each phase the ‘Hows’ and ‘whats’ work simultaneously like,

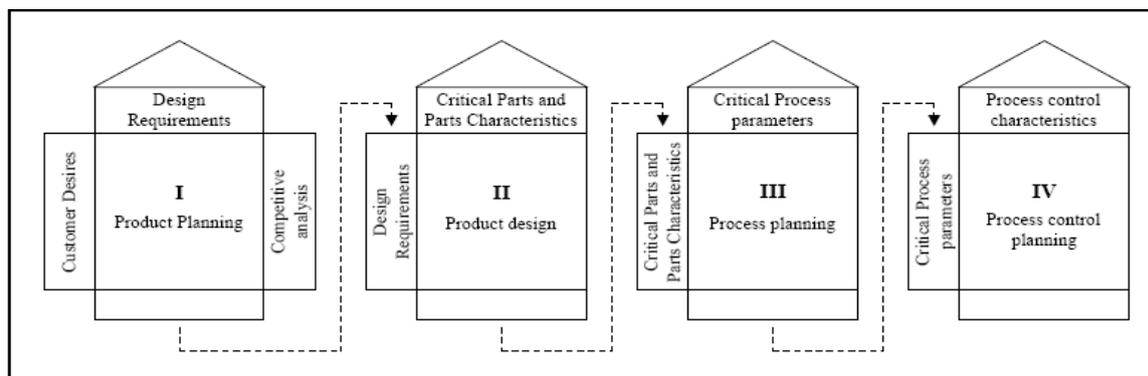


Figure 1. The four phases of traditional QFD.[Ref. 6]

- Requirements of customers –It’s contain the wishes, expectations and the requirements of customers for the product.
- Customer’s ratings - The rating is done on the scale of 1 to 5 and 1 is the lowest point and 5 is the highest grade.
- The competition evaluation of the market -It checks the similar products available in the market and why the customer’s like them and the comparison results given by the customer based on the usage and satisfaction.

a) Technical specifications:

It refers to the requirements of the customers and their satisfaction level and what the customer’s want. It should be within the engineer’s understandable level so that it can be measured and used for further designing. Relationship Matrix means the “what” and “how” requirements of the customers and it must be weighted on the basis of 1-3-9 and 1-3-5. Where 1 is the lowest grade and 9 and 5 the highest. Correlation matrix is a triangular part used to identify the “how” items which support and defeat the quality of the products. Support “how” tells us the efforts taken to avoid the duplication of the product and the negative points tells us the requirements of trade-offs rating it from 2,1, -1 and -2 ratings where -2 is the lowest grading. It tells us the designers about the goals and to give them technical guidance. The goal has to be specific and measurable.

b) Technical assessments HOQ:

The assessment has to be feasible and reliable of all “how’s” items and ratings are 1 to 5 where 5 is the most difficult technical quantity and 1 being the easiest. It is used for comparing the already existing product and the

new products in terms of requirements based on better or worse than the other product. Again on the ratings of 1 to 5 where 1 being the worst and 5 being the best. It is the final step of completing the HOQ for phase 1. The result helps us to know the product requirements and the decision made to trade off the product process.

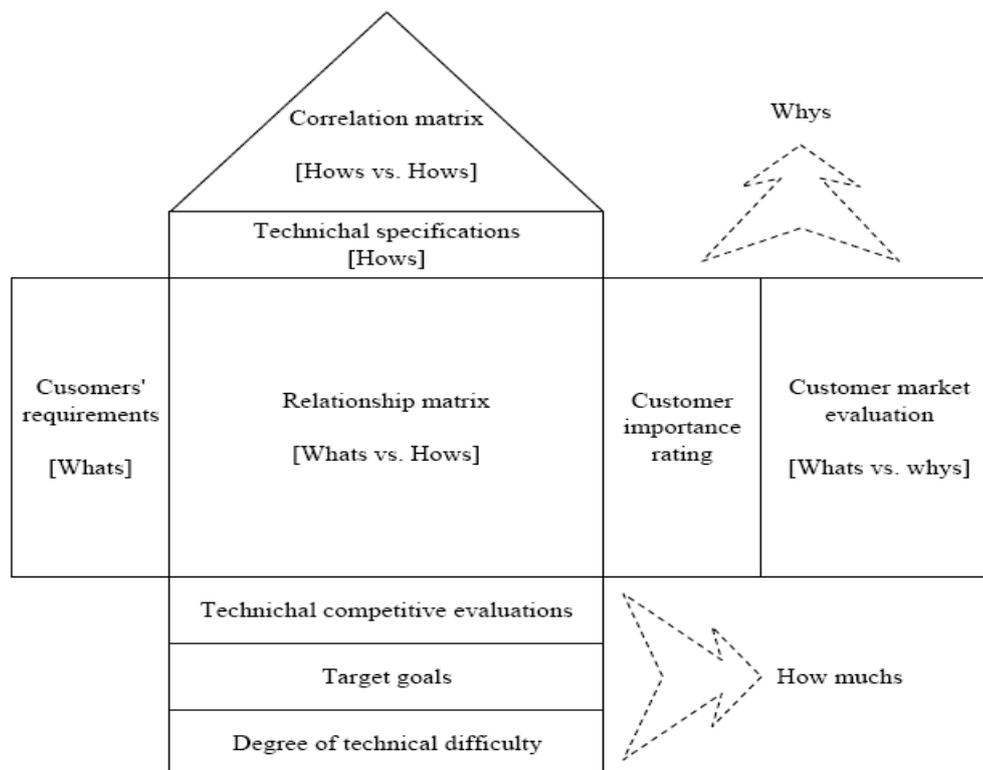


Figure 2. House of Quality (HOQ) in QFD. [Ref. 6]

III. THE FUZZY QFD APPROACH:

a) The fuzzy system and HOQ:

The basic and most important function of HOQ is that it should be designed in such a way to reflect the customer’s preferences and desires. So people from various industry like marketing, manufactures, engineers, etc. should work as a team from manufacturing to delivering the products to the customers to satisfy their needs. The process which are subjected to judgements, delay at times and uncertainty. So, the foremost factor of HOQ is expert’s advice, which consists of CA’s team leaders, group interviews, one- to- one interviews and to understand what the customers and requirements.

Secondly many steps in the HOQ is complex and conflicts arises among team members, so ithas to be a systematic, procedure and patient to analyse the team work and co-ordination is the basis factor for all the team members. At times the procedure is too time consuming, frustrating, and sometimes that there could be a complete breakdown of the team. At the times all efforts are completely dropped too.

The fuzzy logic is to mainly capture the customer’s moods and needs in their linguistic language in a very natural way to facilitate, the expression of the customer’s needs and expert’s knowledge. So to develop a very good relationship with the customers the company have to assist customers in selecting their products,[Sullivan [16] [17] [14], etc.

- Quality charts should not be too large and complex.
- The customers demand should be translated into an understandable way.
- Their independency to select the product should be given to them and perceptions and judgement should not be enforced.
- Correcting the mistakes and changing direction should be done very easily.

b) The fuzzy logic based assistance to HOQ:

Representation of requirements:

The main requirement is to know what the customer wants and develop the resources accordingly. For example, in a textile spinning frame the cost of rubber belt should be low, in yarn the consistency of quality of the product must be high. Like this the customer’s choice and requirements are aligned. Another way to express requirements is using linguistic as it helps in communications among various parties. So hereadopts fuzzy logic to represent the various requirement of the customers and build them accordingly.

‘Domain’ is the universal constrain of the requirements of the customers. A domain consists of all products that is possible according to requirements. Requirement is denoted by R and satisfaction is denoted by sat R, where R’S domain D to a number in 0;1 and this represents the degree of satisfaction(e.g.).

$$\text{Sat } R: D \rightarrow [0,1] \text{ -----(1)}$$

Where D satisfies the requirement on the basis of expression in a canonical form [13,18]

Defination:1

If R is requirement in a system product R: Ai(p) is B where P is a system product, Ai is a property of a product and B is called a fuzzy set. Then

$$\text{Sat } R(p)=\mu_B(Ai(p)) \text{ -----(2)}$$

Where “R” is the life expectancy of the belt should be high.

R: is the life expectancy (P) should be high.

The fuzzy set “high” is an only one possible membership function, and ‘R’ is requirement. It has life expiry about 6 weeks and satisfies the R requirement. Requirement satisfaction R is degree of 0.5. This life expectancy is 5 weeks.

$$\text{Sat } R.(p) = 0.5. \text{ -----(3)}$$

Thus this functions denotes the customer’s requirement and assist them to identify all the parameters of membership functions of requirement in related paper[19]. Techniques have been used identified in a linear and non-linear structures. It’s to identify the customer’s and several approaches.It had been developed to assess the parameters of membership functions. Readers can refer [19] for more details.

a) Identification of requirements in relationships:

There are four types by which it can identify the degree of satisfaction. There are Mutually exclusive,Irrelevant, Conflicting andCo-operative.

If two requirements are not satisfied at the same time they are called mutually exclusive.If one requirement does not have the impact of satisfaction on the other requirement, then it is called irrelevant satisfaction. If one requirement increases the satisfaction and the other decreases the degree of satisfaction. Then it is called confliction, in some cases are may vary.

If one requirement increases the degree of satisfaction of another requirement, then it is called co-operative. But sometimes the two requirements may be completely or partially conflicting. The degree of conflicting or satisfying between two requirements are shown below with definitions.

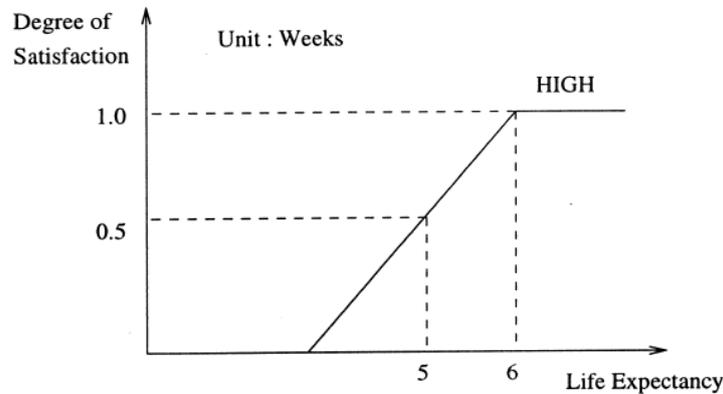


Fig.3. An example HIGH membership function.[Ref. 9]

Definition:2

Let R1 and R2 be the two requirements of a domain Sp. Let U denote the set of pair products. In its increase satisfaction degree of one product decreases the degree of satisfaction of other,

$$U = \{ \langle pi, pj \rangle | pi, pj \in SP, (Sat_{R1}(pi) - Sat_{R1}(pj)) \times (Sat_{R2}(pi) - Sat_{R2}(pj)) < 0 \}.$$

The formula to denote the conflicting requirements of R1 and R2 is said to be $conf. (R1; R2) \geq 0.5$. (Degree of conflicts between requirements)

$$\frac{\sum_{(pi,pj) \in U} | (Sat_{R1}(pi) - Sat_{R1}(pj)) \times (Sat_{R2}(pi) - Sat_{R2}(pj)) |}{\sum_{(ph \in SP)(pk \in SP)ph \neq pk} | (Sat_{R1}(ph) - Sat_{R1}(pk)) \times (Sat_{R2}(ph) - Sat_{R2}(pk)) |}$$

[Ref. 9]

According to the formula of conflicting degree, the two requirements are completely conflicting very easy whenever their conflicting degree is one.

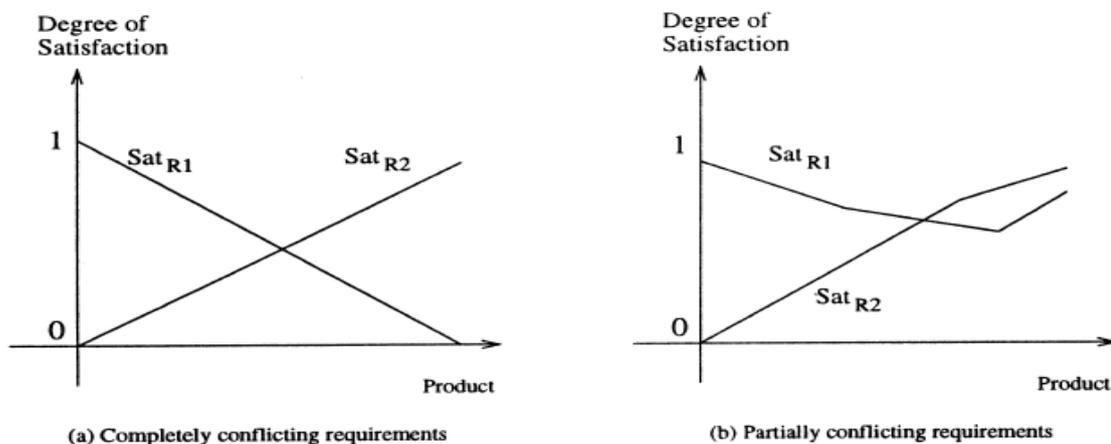


Fig.4 conflicting requirements.[Ref. 9]

The conflicting relationships are denoted by the terms strong, medium and weak etc. These are fuzzy terms used to denote the satisfaction functions. In a fuzzy relationship the requirements that are conflicting are shown as conflicting degree 0.5 and weak conflict is 1.0. confidently saying that the satisfying degree is very less as the strong conflict is 0. If medium conflicts are having two requirements, the degree of satisfaction membership function is 0.6.

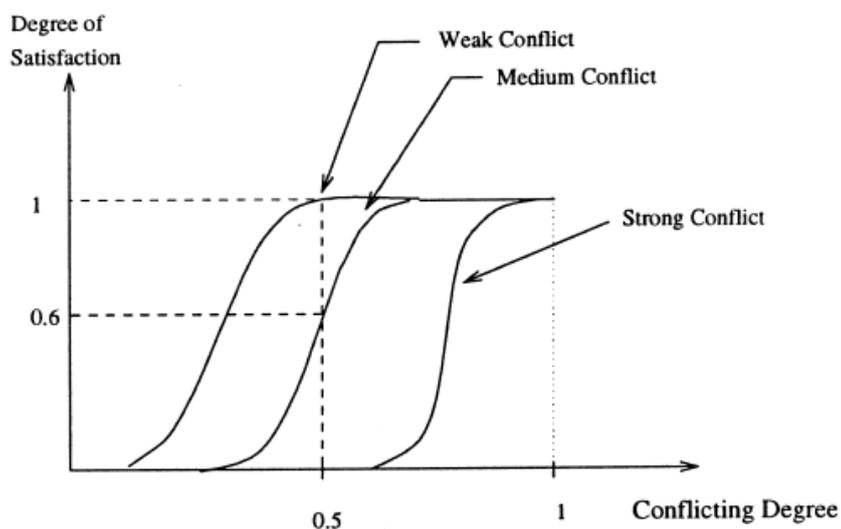


Fig.4 An example of fuzzy conflicting requirements.[Ref. 9]

In a fuzzy relationship the requirements that are conflicting are shown as conflicting degree 0.5 and weak conflict is 1.0. This confidently reflects that the satisfying degree is very less as the strong conflict is 0.

If medium conflicts are having two requirements, the degree of satisfaction membership function is 0.6. so, two requirements may be completely co-operative or completely partial depending on their co-operative degree between the two requirements.

IV. CONCLUSION:

In Japan and America, the HOQ is used widely and describes the customer’s desires and taste in a very natural language. It is the core need to tell the requirements of customer’s needs and wants. HOQ identifies the consuming level of the customers. Particularly, the relation between the requirement has difficulties to arrive at a group consensus and to provide proper tools to be avoided and to find out the conflicting and co-operating requirements. The benefit of the textile mill supply application is to assist all the participants and to identify the meaning and position of all team member requirement. It also assists the team to identify the conflicting requirements and facilitate more effective communication to build a strong business and to take a good decision for the benefit to satisfy the requirements of the product by all the members involved in an HOQ team. This issue can also be implemented using by fuzzy logic methodology and thus can be proved.

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