A Review paper on study and Applications of Quality Function Deployment in Quality improvement

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Abstract **–** Quality Function Deployment (QFD) was conceived in Japan in the late 1960's, and introduced to America and Europe in 1983. Quality function deployment (QFD**)** is a "method to transform user demands into design quality, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process.
In this paper the various applications of QFD are studied and this paper will provide a general overview of the QFD methodology and approach to product development.

Keywords- Quality Function Deployment, house of quality, voice of the customer, customer satisfaction, improvement.

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I. INTRODUCTION

In order to build a quality product, customers' requirements (CR) have to be considered and addressed. From the designer's perspective, customer needs could seem to be vague, qualitative, incomplete and sometimes inconsistent. Customers only express *what* they want. Most likely these *what's* do not imply any "what exactly" in terms that make sense to designers, e.g. easy to use. Designers need to figure out *how* these *what's* can be satisfied by a product/service. Designers need detailed, technical-oriented requirements (*how's*) for design. There is an obvious gap between *what's* and *how's*. Customers "what's" are usually expressed in customers' own language without any implication of technology and implementations. These customers *what's* need to be translated into designers *how's,* which are quantitative, measurable and actionable technical specifications, so that they can be used by designers for design. *Hows* are designers understanding in technical terms of customers *what's*. Quality Function Deployment (QFD) is one of the techniques that can bridge the gap and help translate customers whats to designers.

A. When to use QFD**:**
QFD is applied in the early stages of the design phase so that the customer wants are incorporated into the final product. Furthermore it can be used as a planning tool as it identifies the most important areas in which the effort should focus in relation to our technical capabilities. Ask yourself these questions:
1. Why do QFD in this case?
2. What will the QFD be made of?
3. Is it the right tool at this time?
4. Is this the right place for implementation?
5. What is the goal and what is success?
6. Who all should we involve

B. How to use it?
1. Product Planning (House of Quality): Translate customer requirement into product technical requirement to meet them.
2. Product Design: Translate technical requirement to key part characteristics or systems.
3. Process Planning: Identify key process operations necessary to achieve key part characteristics.
4. Production Planning (Process Control): Establish process control plans, maintenance plans, training plans to control operations

II. LITERATURE REVIEW

The literature review has been done to study and understand the Quality function deployment tool and how it is applicable in product quality improvement and customer satisfaction.

Dr.Arash shanin et. al has done an comprehensive study and reviewed the QFD and had provided the areas for improvement which could serve as an opportunity for various products. Chatree homkhiew et. al (2012) has focused on the application of the QFD and had applied it to the design and development of the furniture products according to the requirement of the customer and had suggested that the QFD is most superior technique for customer satisfaction. Sunday ayola oke (2013) has focused evaluating the past QFD methodologies and applications with a view to providing readers with an overall vision on the development of QFD. Specifically the results obtained in

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the current study points out to the follow conclusions: (i) that the dynamic nature of QFD through enrichment with other concepts has not been affected by cost; (ii) neural networks have not been fully explored to the advantage of QFD area; (iii) other phases of QFD, vis-à-vis process planning and product planning processes need more studies; and (iv) QFD is customer focused and how the feedback system from customer complaints could be integrated to the existing frameworks on QFD is missing.

III. QFD Methodology And The House Of Quality

The QFD method includes building one or more matrices known as „quality tables." The first matrix is named the "House of Quality" (HoQ). It exhibits the customer"s needs (VoC) on the left hand side, and the technical response to meeting those needs along the top. The matrix is usually completed by a specially formed team, who follow the logical sequence suggested by the letters A to F, but the process is flexible and the order in which the HOQ is completed depends on the team.

A four phases approach is accomplished by using a series of matrixes that guide the product team"s activities by providing standard documentation during product and process development (Figure below). Each phase has a matrix consisting of a vertical column of "Whats" and a horizontal row of "Hows". "Whats" are CR; "Hows" are ways of achieving them. At each stage, the "Hows" are carried to the next phase as "Whats"

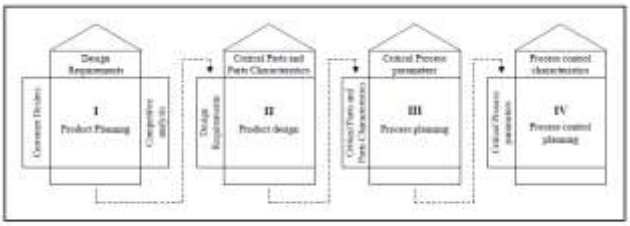

Figure – The four phases of traditional QFD

Phase 1, Product Planning: Building the House of Quality. Led by the marketing department, Phase 1, or product planning, is also called The House of Quality. Many organizations only get through this phase of a QFD process. Phase 1 documents customer requirements, warranty data, competitive opportunities, product measurements, competing product measures, and the technical ability of the organization to meet each customer requirement. Getting good data from the customer in Phase 1 is critical to the success of the entire QFD process.

Phase 2, Product Design: This phase 2 is led by the engineering department. Product design requires creativity and innovative team ideas. Product concepts are created during this phase and part specifications are documented. Parts that are determined to be most important to meeting customer needs are then deployed into process planning, or Phase 3.

Phase 3, Process Planning: Process planning comes next and is led by manufacturing engineering. During process planning, manufacturing processes are flowcharted and process parameters (or target values) are documented.

Phase 4, Process Control: And finally, in production planning, performance indicators are created to monitor the production process, maintenance schedules, and skills training for operators. Also, in this phase decisions are made as to which process poses the most risk and controls are put in place to prevent failures. The quality assurance department in concert with manufacturing leads.

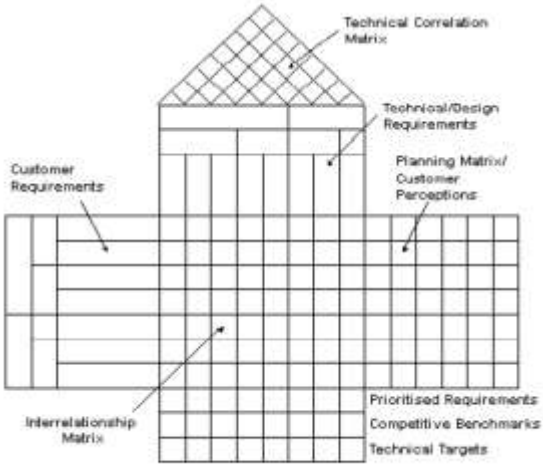

Figure – House of Quality

1. Clarifying Customer Needs and requirements-

Customers buy benefits and producers offer features. This seems like a relatively simple notion, however,

unless customers and producers are perfectly in tune with one another, it may be very difficult to anticipatet hese features, or each underlying benefit from each producer. It is of utter importance to translate the wishes of each and every customer into some tangible values that can be turned into engineering specifications. After determining what items are most important to the customer, organizations must translate them into particulate specifications. Nothing can be produced, serviced or maintained without detailed specifications or some set of given standards. Each aspect of the desired item must be clearly defined: Measurements be defined, heights specified , torques stated, and weights targeted.These values can be derived from several locations. Organizations can use known data from market research, or conduct new studies to gather necessary information. In any event, the needs, which were clarified and then explicitly

stated, should be satisfied to the best of that organization's ability.

2. Technical Requirements

The next step of the QFD process is identifying what the customer wants and what must be achieved to satisfy these wants. In addition, regulatory standards and requirements dictated by management must be

Identified. Once all requirements are identified it is important to answer what must be done to the product design to fulfill the necessary requirements.

3. Planning Matrix

The next step in the QFD process is forming a planning matrix. The main purpose of the planning matrix is to compare how well the team met the customer requirements compared to its competitors. The planning matrix shows the weighted importance of each requirement that the team and its competitors are attempting to fulfill. Customer ratings, typically ranging from 1 to 5, are given to each company under each requirement. The customer ratings are combined with the weighted performance of each demand to produce an overall performance measure for the companies.

4. Interrelationship Matrix

The main function of the interrelationship matrix is to establish a connection between the customer's product requirements and the performance measures designed to improve the product. The first step in Constructing this matrix involves obtaining the opinions of the consumers as far as what they need and require from a specific product. These views are drawn from the planning matrix and placed on the left side of the interrelationship matrix.

With this customer overview, the company can begin to formulate a strategy to improve their product. In doing this, the strengths and weaknesses of the company are weighted against the customer priorities to determine what aspects need to be changed to surpass the competition, what aspects need to change to equal the competition, and what aspects will be left unchanged. The optimal combination is desired. Knowing what improvements need to be made allows the list of performance measures to be generated and displayed across the top of the interrelationship matrix. By definition, a performance measure is a technical measure evaluating the product's performance of a demanded quality. In other words, the company must take the voice of the customer and translate it into engineering terms. The matrix will have at least one performance measure for each demanded quality.

After setting up the basic matrix, it is necessary to assign relationships between the customer requirements and the performance measures. These relationships are portrayed by symbols indicating a strong relationship, a medium relationship, or a weak relationship

5. Technical correlation Matrix

Performance measures in existing designs often conflict with each other. The technical correlation matrix, which is more often referred to as the Roof, is used to aid in developing relationships between customer requirements and product requirements and identifies where these units must work together otherwise they will be in a design conflict. The following symbols are used to represent what type of impact each

requirement has on the other.
++ - Strong positive
+ - Positive
- - Negative
-- - Strong negative
These symbols are then entered into the cells where a correlation has been identified. The objective is to
highlight any requirements that might be in conflict with each other.

IV. QFD BENEFITS

1. Major reduction in development, time and cost, shorter design cycle and changes. Significantly reduces start up problems, times and costs

2. The quality and productivity of service become more precise in a continual improvement process and the company can reach world class.

3. Improved Communication within the organization. Brings together multifunctional teams and encourage team work and participation .

4. Leads to truly satisfy and delighted customer .

V. CONCLUSION

In this paper, an attempt was made to demonstrate the capabilities of QFD which has been regarded as one of the most important advanced quality engineering techniques and also the various papers were studied for knowing its hoe it is applied. QFD is a quality design and improvement technique and relatively is closer to the customers than other techniques. Also, QFD can serve as a flexible framework, which can be modified, extended, and be combined with other quality design and improvement techniques. There are still not enough publications about the use of QFD in service areas. However, comparing with other quality design techniques, QFD has the potential to be the most suitable

technique for designing quality from customers' point of view.

REFERENCES

[1] Sunday Ayoola oke, "Manufacturing Quality Function Deployment: Literature Review and Future Trends,", vol. 14, Issue 3

[2] Chatree Homkhiew, Thanate Ratanawilai*, and Klangduen Pochana, "Application of a quality function deployment technique to design and develop furniture products", pp 663-668, Nov. - Dec. 2012

[3] Robin Rawlings-Quinn, "QUALITY FUNCTION DEPLOYMENT (QFD): A CASE STUDY",

[4] Vonderembse, M.A. and Raghunathan, T.S. (1997) Quality function deployment‟s impact on product development, International Journal of Quality Science, Vol.2, No.4, pp. 253-271

[5] Chan, L. K. and Wu, M. L., 2002b, Quality function deployment: A literature review, European Journal of Operational Research, 143(2002), 463-497

[6] Chan, L.K. and Wu, M.L. (1998) Prioritizing the technical measures in quality function deployment, Quality Engineering, Vol.10, No.3, 67-479.

[7] L-K. Chan, and M-L. Wu, "Quality function deployment: A literature review," European Journal of Operations Research, vol. 143, pp. 463-497, 2002.

[8] C. M. Tan, "Customer-focused build-in reliability," *International Journal of Quality and Reliability Management*, vol. 20, no. 3, pp. 378-397, 2003.