A STUDY ON QUALITY FUNCTION DEPLOYMENT IN CONSTRUCTION PROJECT

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Abstract- **The main aim of this study is to improve the quality and product satisfication based on the customer needs and wants. This method was first introduced in the manufacturing industries for the success of the product and later it was applied in the construction industries by various changes. By using QFD application the requirement of the customer are analysied and report was taken based on the report the construction process will done.**

1.0 INTRODUCTION

QFD provides a set of communication routines that coordinates the efforts and skills available in an organization from the project's inception to its completion. QFD creates a culture that is noticeably different from the traditional culture, which assumes that designers knew best and customers would automatically be satisfied with the end product. The QFD culture is a culture in which all customers are kept at the heart of the development process of the product. The term "all customers" means not only the owner's staff, but also those who use, maintain, or participate in making the subject product. Unless all customers are satisfied, a product would not be viewed as fully successful.

2.0THEORY AND FRAME WORK

Effective application of QFD hinges on forming the proper implementation team and employing the QFD tools. The first task for the QFD implementation team is to identify the needs and wants of all customers. Then, the team uses a number of QFD tools to translate the customer's needs to measurable engineering characteristics. Proper deployment of the implementation team encompasses three phases 1.Conceptualizing the subject issue 2. Collecting the necessary data 3. Analyzing and reporting the results of the data To identify customers needs and wants, QFD employs the focus group approach as the data collection method to ensure a comprehensive means to collect the customers requirements and expectations. Tools such as affinity diagram, tree diagrams, and the house of quality are used to understand the voice of the customers and forecast the expected success of the end product. These tools/procedures are briefly described below

3.0 CONSTRUCTION OF HOUSE OF QUALITY DIAGRAM

The primary tool of QFD is the house of quality. The HOQ is a useful tool for arranging facts so that important issues, relationships among these issues, the significance of each, and their measures of success can be readily displayed

Section I: Customer needs and requirements (voice of customer, VOC)
Section II: Technical measures
Section III: Planning matrix
Section IV: Relationship matrix
Section V: Correlation matrix
Section VI: Weights, benchmarks and targets

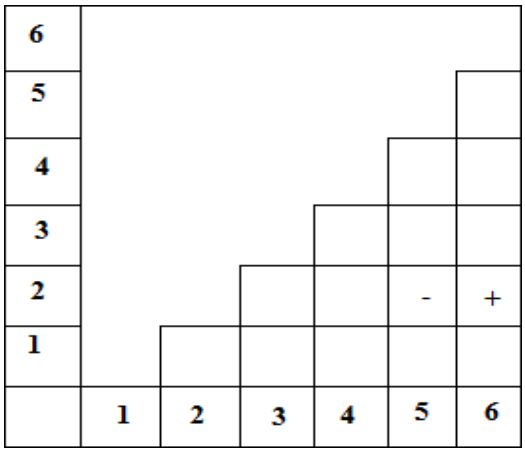
The steps for the construction of the house of quality can be described as follows:

Step 1-List Customer Requirements (WHATs):

The first step in a QFD project is to determine what market segments will be analyzed during the process and to identify who the customers are. The team then gathers information from customers on the requirements they have for the product or service. In order to organize and evaluate this data, the team uses simple quality tools like Affinity Diagrams or Tree Diagrams.

QFD starts with a list of goals/objectives. This list is often referred to as the what's that a customer needs or expects from a particular product.

Steps 2- List Engineering Characteristics (HOWs)



The goal of the HOQ is to design or change the design of a product in a way that meets or exceeds customer expectations. Now that customer needs and expectations have been expressed in terms of customer requirements, the QFD learn must come up with the engineering characteristics that will affect one or more of the customer requirement and be expressed in measurable terms.

Step 3- Develop a Relationship Matrix between the WHATs and the HOWs

The next step in building an HOQ is to compare customer requirements and engineering characteristics, and to determine their respective relationships. The task of tracing the relationships between the customer requirements and the engineering characteristics can become very complex, because each customer requirement may affect more than one engineering characteristics, and vice versa.

The inside of the HOQ, called the relationship matrix, is now filled in by the QFD team. The relationship matrix is used to represent graphically the degree of influence between each engineering characteristics and each customer requirements. This step may take a long time, because the number of evaluation is the product of the number of customer requirement and the number of engineering characteristics. Doing this early in the development process will shorten the development cycle and should lessen the need for future changes.

It is common to use symbols to represent the degree of relationships between the customer requirements and engineering characteristics. For example the following system can be adopted;

A dark circle (o) represents a strong relationship.

A single circle (O) represents a medium relationship.

A triangle (Δ) represents a weak relationship.

The box is left blank if no relationship exists.

During the quantitative analysis of the importance weights of the engineering characteristics, the symbols that are used to define the relationships are replaced with numbers, for example:

Strong relationship = 5 (or 9)

Medium relationship = 3

Weak relationship = 1

Step 4- Develop an interrelationship Matrix between pairs of HOWs

The roof of the HOQ, called the correlation matrix, is used to identify any interrelationships between pairs of engineering characteristics, it is a triangular table attached to the engineering characteristics. Symbols are used to describe the strength of the interrelationships. For example, similar to the case of the relationships matrix, the following system can be used:

A dark circle (o) represents a strong positive relationship.

A single circle (O) represents a positive relationship.

A single X represents a negative relationship.

A double XX represents a strong negative relationship.

The correlation matrix allows the user to identify which engineering characteristics are most important because they are frequently the result of conflicting customer requirements and, consequently, represent points at which trade-offs must be made. Trade-offs that are not identified and resolved will often lead to unfulfilled requirements, engineering changes, increased costs, and poorer quality. Some of the trade-offs may require high level managerial decisions, because they are cross- functional area boundaries. Even

though it is difficult, early resolution of trade-offs is essential to shorten product development time.

It should be pointed out that in some other places the interrelationships are simplified to have only two kinds of relationships, namely; negative and positive relationships. A symbol "+" is often used for synergy and a "-" is used for compromise. Example of correlation matrix:

Step 5- Competitive Assessments

The competitive assessments are a pair of weighted tables that compare the performance of the current organization's products in their key specifications with those of their competitors. The competitive assessment tables are separated into two categories, customer assessment and technical assessment

Step 6 – Develop the Prioritized Customer Requirements

The prioritized customer requirements make up a block of columns corresponding to each customer requirement in the HOQ on the right hand side of the relationship matrix. These prioritized customer requirements contains columns for importance to customers, target values, scale- up factors, sales points, and absolute weightings of the customer requirements.

Step 7- Develop the Prioritized Engineering Characteristics

The prioritized engineering characteristics make up a block of rows at the bottom of the HOQ corresponding to each engineering characteristic in the HOQ. These prioritized engineering characteristics contains the degrees of technical difficulty, the target values, and absolute and relative weights. The QFD team identifies engineering characteristics that are most needed in fulfill customer requirements. These measures provide specific objectives that guide the subsequent design and provide a means of objectively assessing progress and minimizing subjective opinions

3.0 APPLICATION OF QFD IN APARTMENT BUILDING PROJECT

This section demonstrates the use of QFD in medium–large scale Construction Company mainly involved in the housing sector. In this QFD tool is used for the apartment design in design phase and after the design phase i.e. during the marketing. As seen in the previous section QFD methodology first step of application.

3.1 Some of the important features chosen after the survey are as follows.

1. At least two entrance for the apartment unit: one by the living room and another by the kitchen.
2. A large counter top in the kitchen to provide more space during the preparation of food or othertasks.
3. Floor easy to clean in the kitchen andbathroom.
4. Beautiful wood floor in the living and diningrooms.

3.2 Formation of Relationshipmatrix

By using the correlation between the customer needs (Whats) and the technical requirement (Hows), it was possible to determine strength of relationship and impact on the need in order to fill the appropriate section of the HOQ matrix (Section 4), the relationships between customer needs and technical measures have to be identified subjectively. This step is essential to understand the contribution of each technical measure in overall customer satisfaction level as well as to see how the technical measures are helpful to satisfy each customer expectation.

3.3 Technical measures

The technical measures corresponding to each customer need have been identified in the next step. Technical measures reflect the solutions selected by the company to supply the customers with their need. They help the different disciplines working on the project, to understand customer requirement in the same meaning and avoid confusions that can be faced while interpreting the customer needs.

3.4 ASSIGNING RELATIVE IMPORTANCE TO CUSTOMERREQUIREMENT

In order to obtain the relative importance of the requirement, the author gives the list of requirement to the selected 20 person. And say him to give your importance on 1 to 5 scales for design phase requirement and 1 to 9 for marketing phase. Based on the statistic collected from the sample size of 20 relative importance is carried out by taking average of ranking. List

of relative importance is attached in the annexure.

3.5 **DETERMINATION OFBENCHMARK**

After analyzing the specification of flats and facilities provided by the other rival company benchmark is decided (improved ratio). All the case study with specification, facilities provided and plans of flats are attached in annexure.

4.0 ANALYSIS OF CASESTUDIES

The case study covers a QFD exercise carried out for a medium-large scale construction company mainly involved in the housing sector. Case studies are chosen for the high income group (H.I.G). The most important point in application of QFD is the customer selection. Because different people has different requirement it will depend on the style of living. So specifically the case study is taken from HIGInsurancerisks

4.1 Basis of case studyselection

QFD can apply to any group, for that only customer requirement and technical requirement changes. The case studies are taken from TIRUPUR.

QFD is applied on VAK Builders. to determine the best marketing strategy of company and also strength/weaknesses of their ongoing project. Other two casse studies i.e. SKP engineers, TIRUPUR is taken for the comparative analysis (Benchmarking). This is the competitor in the market housing sector in TIRUPUR

4.2 The aims of the QFD case studies are indicated as follows:

1.Determination of a marketing strategy by identification of expectations of the target customer groups and comparing the strength/weaknesses of the housing complex with those of alternative housing projects available in themarket.

2.Using the current QFD case study findings to facilitate decision-making in forthcomingprojects.

3.Formation of a systematic procedure which may guide the decision makersin all stages of the construction value chain including feasibility analysis and design so that the company may create a competitive advantage within the housing market by "qualitydifferentiation".

risk (Eric Verzuh 2005).

5.0 SUMMARY

5.1 INTRODUCTION

QFD is an effective planning tool that invites the participation of the customers who could affect or be affected by proposed design. In this process, both spoken and unspoken needs of the customers are determined, prioritized, and translated to design parameters. Such design parameters are assigned specific target values and are frequentlycheckedagainstcustomer"sneedsthroughoutthedevelopmentcycletoensure customer"s satisfaction with the end product. In other industries, QFD has been successful in developing new products that achieved high customer satisfaction. These industries include automotive, electronics, banking, insurance, healthcare, utilities, and food processing. Similar results were expected for the subject thesis. Unlike these industries, the number of companies that have attempted the implementation of QFD in the construction industry isinsignificant.

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5.2 LIMITATIONS AND CONSTRAINTS OFQFD

As well as its benefits defined so far, the QFD methodology has some limitations for practical implementation. QFD methodology encounters some problems in construction projects regardless of which stage of construction it is utilities. The potential limitations should be noted for the potential users of QFD so that corrective actions can be planned beforehand. These limitations and breakthroughs which have been experienced both in the case study implementation and reviewed in the literature findings can be classified under two categories as global limitations(i.e. limitations due to its philosophy) and application-specific limitations (i.e. limitations according to its practical implementation).

6.0 CONCLUSIONS

QFD is a valuable and very flexible tool for Design. The sequence of parts and steps during the QFD process can be changed according to the strategy adopted by the design team. The correlation matrix is the heart of the QFD process and stores precious information needed for design improvements.

QFD helps prioritize the improvements and design specifications. QFD also helps translating the buyers and users needs into information that can be managed by the design team. Besides, it facilities the use of benchmarking information in a systematic way. The most difficult aspect in the use of the QFD as a tool in the design of a real estate project was the previous lack or strong coordination in the beginning of the project especially in features related to detail solutions. Another difficult was making the project team recognize that QFD is a powerful and flexible tool for construction. One last important issue in the use of QFD is the size of the core matrix.

QFD provide the framework to the architect and engineer for designing the project and writing the project specification i.e. design improvement as found in the previous section of QFD findings. It should be noted that there are some difficulties associated with the QFDprocess

The process provides a systematic procedure and a forum for all parties affecting or affected by the project to communicate their needs objectively, priorities such needs according to the overall project goals, reach a consensus systematically, and make critical decisionsin a manner- that eliminates design mistakes and oversights. Thus, QFD process can minimize cause of construction delays, materials waste, and quality degradation.