



Employing Quality Function Deployment for Integrated Design

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Abstract : It is a truism that despite having the most profound effect on the comfort and working environment, as well as being the largest contributor to the operation and maintenance cost of any structure, services are invariably dealt with as an afterthought in most project. As a result, proper integration, both among services and of the services with the structure, which is essential to optimize the building as a whole, is rarely achieved. The objective associated with building services has been identified with a view to evolve a structured approach to the problem, including a method of quantifying and analyzing the requirements, which designers can use in the integration process. To this end, a modified quality function deployment approach has been suggested and illustrated with the design of a new multi-storey building hospital building.

Keywords: building house of quality, building services, customer requirement, technical requirement, QFD methodology,

I. INTRODUCTION

QFD is a methodology to be adopted to improve products quality, which has introduced a twofold innovation in traditional product development processes. First, the application of QFD requires the careful consideration to customers during the product development process. Second, QFD approach introduces the collaboration among business areas as a prerequisite for product design. QFD could be applied to various issues such as business strategies realize QFD can help organizations develop manufacturing strategies. Employment of the system design approach as a means of achieving better integration of building services as part of an optimal overall design. the design should not only ensure integration of the services with each other and with the building form and structure, while meeting the customer requirement, but do so within budgetary and other constraint. the system design approach, while being compressive, suffer from some drawback in this regard.

II. AIM OF STUDY

- Identify the objective that each service must fulfill.
- Decide, preferably in quantitative terms, their importance to the Owner/user.
- Decide, preferably in quantitative terms, the inter se importance of the desired services and their components.

III. BACKGROUND

QFD has its roots in Japan of the late 1960 and early 1970. The Japanese created a methodology to support the development process for complex products, such as supertankers, by linking the planning elements of the design and construction processes to specific customer requirements.

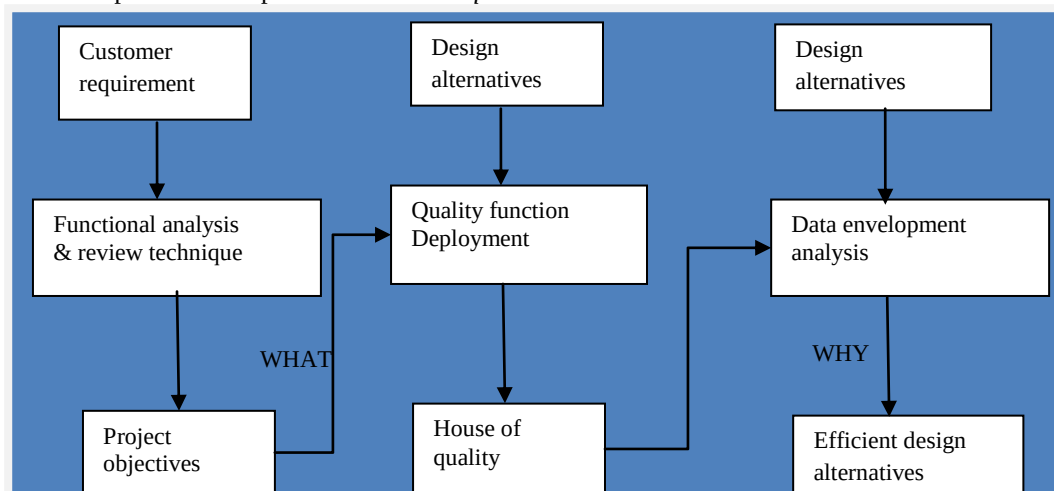


Fig.1: General Approach

By applied this technique, numerous Japanese companies enabled their product development efforts to more effectively focus on meeting customer expected, thus building a distinct competitive advantage. The successes of QFD by companies in the United States starting in the early 1980. Since then, with applications across many different manufacturing and service based companies in the US, QFD has led to some dramatic success stories: reductions in overall project costs (e.g. 50%), reductions in project cycle time (e.g. 33%), and major increases in productivity (e.g. 200%)

IV. FORMULATION OF QFD

At the first stage, market requirements and competitive factors are identified respectively, and then the impact of each competitive factor on each market requirement is measured by using HOQ. At the second stage, competitive factors are used as “what’s” in HOQ matrix, and manufacturing decision categories are identified and used as “how’s” in HOQ matrix. Then the “how” — “what” correlation scores are determined and the “how’s” are weighted.

Stage 1: Determining competitive factors in terms of market requirements

There are six steps comprised in Stage 1 which are shown as S_i ($i = 1 \dots 7$) in Fig.no.2

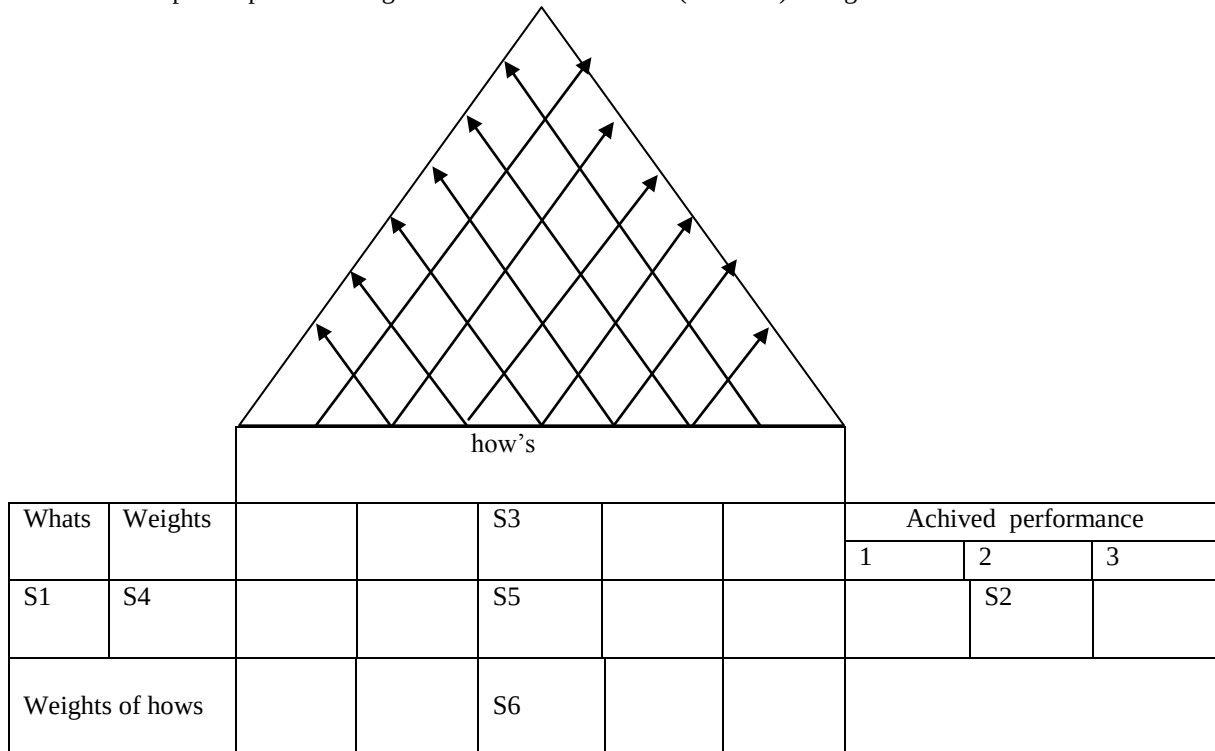


Fig.2: The steps for constructing HOQ

Step 1 (S1): Identifying the “what’s” by measuring market requirements. This step identifies the product characteristics which are identified by measuring market requirements. These product characteristics are used as “what’s” in HOQ matrix.

Step2 (S2): Comparing achieved performance of manufacturing with market requirements. This comparison identifies the areas where current manufacturing capabilities must improve.

Step 3 (S3): Identifying competitive factors — “hows”. This step translates market requirements into competitive factors, which links market requirements and manufacturing strategy.

Step 4 (S4): Weighting market requirements. Market requirements reflect the taste of customers to product, which can be measured by different ways.

Step 5 (S5): Linking market requirements with competitive factors. This step determines the correlation scores of market requirements and competitive factors.

Step 5 (S6): Determining the weights of competitive factors. In this step the match between these order winners/qualifiers and a market requirement is analyzed, and the weights of the competitive factors are determined. The weights of the “how’s”, identified as area (S6), are placed at the base of the HOQ. These weights are determined by: $Weight(how)_i = V(how)_i \times imp(what_1) + \dots + V(how)_i \times imp(what_n)$, where $V(how)_i$ is the correlation value of “how_i” with “what_n”, and $imp(what_n)$ represents the importance or priority of “what_n”.

Step 6 (S7): Developing the matrix of correlations between the “hows”. The correlations between the “hows” are contained in the “roof” of the HOQ. After the determination of the impact of each competitive factor on market requirement, stage 2 can be started where the key manufacturing strategic decisions that will support those competitive factors could be identified.

In convectional QFD application, a cell I_j in the relationship matrix of hoq i.e. i th row and j th column of HOQ is assigned values (e.g. 1,3,9) to represent a weak medium or strong relation between i th customer requirement (cr) called cr_i and j th design requirement (dr) called dr_j , respectively . the absolute and relative importance of drs are computed using the relative importance of CRs and relationship rating (i.e. 1,3,9). For each dr , the absolute importance rating is computed as follows

$$AI_j = \sum_{i=1}^m R_{ij} w_i$$

For $i=1, \dots, m \dots (1)$

The absolute importance rating can then be transformed into the relative importance rating RI, as follows

$$RI_j = \sum_{i=1}^m R_{ij} w_i$$

For $i=1, \dots, m \dots (2)$

Where

W_i =degree of importance of Cr_i

R_{ij} = strength of relationship between Cr_i and DR_j , $j=1,2, \dots, n$

AI_{ij} = absolute importance rating of DR_j

RI_{ij} = relative importance rating of DR_j

The larger the RI, the important is DR . thus , without consideration of any other constraint e.g. cost and time , DR s should be incorporated into the product of interest in the order of their relative importance rating to achieve more customer satisfaction.

Exterior Glass	Curved											
	Straight with framing	N/A										
	Remove curvature from design	N/A	N/A									
Interior Glass	Retractable	1	1	1								
	Fixed	1	1	1	N/A							
Lighting	Elaborate	1	1	1	1	1						
	Regular	1	1	1	1	1	N/A					
Furniture	Expensive	1	1	1	1	1	1	1				
	Simple	1	1	1	1	1	1	1	N/A			
HVAC	Individual Control	1	1	1	1	1	1	1	1	1		
	General Control	1	1	1	1	1	1	1	1	1	N/A	
		Curved	Straight with framing	Remove curvature from design	Retractable	Fixed	Elaborate	Regular	Expensive	Simple	Individual Control	General Control
		Exterior Glass			Internal Glass		Lighting		Furniture		HVAC	

Fig. 3: Compatibility matrix for various design elements

V. CONCLUSION

In this study, the various objectives that services would generally be required to meet and broadly, the means available to achieve them have been identified. Various aspects requiring coordination between professional to ensure integration between the services have also been identified. While the various potential objectives of services have been identified, their degree of importance would differ with the type of building and from owner to owner, therefore, ideally, there should be an easily quantified method through which designers can take decision about which services or design requirement to give priority over the other in design, when conflicts occur.

VI. REFERENCES

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