Integrating quantitative techniques with quality function deployment

Nowadays consumers are more informed, more demanding, and they easily change brands and companies if their requirements are not met on time and at a price they are willing to pay. Among others, delivering high service quality is considered an essential strategy for success and survival in this competitive environment.

Service quality is one of the most important issues in achieving comparative advantage and financial success in the service sector. A well-known method, that is successful in designing high quality services resulting in customer satisfaction, is Quality Function Deployment (QFD).

QFD in the service sector

Quality Function Deployment (QFD) is a service planning and development support method, which provides a structured way for service providers to assure quality and customer satisfaction while maintaining a sustainable competitive advantage. The goal of QFD is enhanced customer satisfaction, organizational integration of expressed customer wants and needs and improved profitability.

QFD differs from traditional quality systems which aim at minimizing negative quality such as poor service. QFD focuses on delivering “value” by seeking out both spoken and unspoken customer requirements, translating them into actionable service features and communicating them throughout an organization. It is driven by the “voice of the customer” and because of that, it helps service providers to address gaps between specific and holistic components of customer expectations and actual service experience. In addition, it helps managers to adopt a more customer-driven perspective, pointing out the differences between what managers visualize as customer expectations and the actual customer expectations.

QFD is developed by a cross-functional team and provides an excellent interdepartmental means of communication that creates a common quality focus across all functions/operations in an organization. The unique approach of QFD is its ability to integrate customer demands with the technical aspects of a service. It helps the cross-functional team to make the key tradeoffs between the customers' needs and the technical requirements so as to develop a service of high quality. Hence, QFD is not only a methodological tool but a universal concept that provides means of translating customer requirements in each stage of service development.

A well-designed QFD process is able to link customer requirements, service specifications, target values and competitive performance into a visual planning matrix. QFD involves the construction of one or more matrices, called "quality tables", which guide the detailed decisions that must be made throughout the service development process. The first of these "quality tables", called "The House of Quality (HOQ)", is the most commonly used matrix in the QFD methodology. The traditional four-phased, manufacturing QFD methodology is modified slightly so that it can be applied to the service industry and involves three quality matrices instead of four.
QFD has been introduced successfully to the service sector. The reported implementations are in various service areas such as education, e-banking, healthcare, hospitality, public sector, retail, spectator event, technical libraries and information services etc.

Benefits of QFD

To a large extent, the widespread acceptance of QFD is due to its numerous benefits. Some of the most important benefits that are found include:

- Fewer design and service costs due to the reduction of irrelevant processes and fewer and earlier design changes because of the early identification of high risk areas.
- Lower cycle time and cost minimization of midcourse changes and implementation errors.
- Fewer start-up problems and better company performance.
- Improved service designs that meet or exceed customers' expectations.
- Better handling of increased demand and efficient allocation of resources.
- Establishment and maintenance of documentation due to the fact that information is stored in the matrices so none of the details is lost over time.
- More stable quality assurance planning and increased possibility for breakthrough innovation.
- Identification of future application opportunities and effective use of competitive information.
- Improved service quality since QFD helps prioritizing customer requirements in order of importance from the customer viewpoint.
- Increased customer satisfaction due to the fact that QFD helps understanding the actual customer requirement.
- Improved exchange of ideas and increased communication within the organization. QFD changes management communication patterns from “up-over-down” flows to more horizontal routes. Cross-functional team members communicate directly with one another.

Limitations of QFD

On the other hand, various problems, encountered at some stage of the implementation of QFD, have been reported. Specifically, QFD limitations include:

- QFD methodology imposes the need to deal with large amounts of data gathered from customers, competitors, cross-functional teams, etc.
- The manual input of customer survey into the HOQ is time-consuming and difficult.
- The HOQ can be large and complex. It is not easy and it is time consuming to have to assess the relationships between each customer requirement and service characteristic, as well as the correlations among the various service characteristics.
- Setting target values in the HOQ is often imprecise.
- The voice of the customer contains ambiguity and different meanings due to the fact that not everyone has the same perception of a particular linguistic description.
Owing to the need to input and analyze large amounts of subjective data, bias may be easily injected into any stage of the QFD implementation and an invalid conclusion may be drawn.

The QFD method is an ongoing process, thus errors at one stage will propagate to successive stages.

Since the voice of the customer is generally expressed in customers’ language and not in terms of service features, it has been suggested that it might be difficult to translate customer demands into measurable service features.

Also, strengths of relationships are sometimes ill-defined. More specifically, the QFD approach uses absolute importance to identify the degree of importance for each customer and service requirement, assuming that accurate and representative data in an absolute scale is available.

QFD assumes that a linear relationship exists between customer requirements and service attributes.

Another drawback is that QFD analyses are often limited to the first HOQ, breaking the links between the three QFD phases.

QFD assumes that the customer requirements are deterministic, thus remaining unchanged over time.

Last but not least, QFD is mainly a qualitative method.

The above criticism has prompted the need for new approaches to the application of the QFD method. The effectiveness of QFD could be improved through the utilization of quantitative techniques such as the Analytic Hierarchy Process (AHP), the Analytic Network Process (ANP) and Markov Chains.

The integration of qualitative QFD with quantitative techniques could help to overcome previously identified shortcomings and yield greater benefits from its implementation. Efforts, also, should be made to automate the HOQ and reduce the required time to complete it.

Quantitative techniques integrated with QFD

Customer requirements prioritization is a critical part of QFD implementation. Traditional QFD requires from customers to translate their perceptions into numerical scales, through mechanisms like the Likert scale. In this respect, customers are asked to evaluate whether a relationship is weak, moderate or strong and their answers are translated to a scale like 1-3-5, 1-4-7 or 1-5-9. Then, the service features are prioritized according to their additive impact on customer requirements using a relationship matrix. However, not all the customers have the same perception of a particular linguistic description and additionally, the choice of scales can dramatically influence the outcome. Also, it is common for customers to respond quite differently from what they really mean and tend to rate almost everything as important.

To tackle these problems the AHP technique has often been adopted. AHP is used in the HOQ in order to determine the intensity of the relationship between the customer requirements and the service features. AHP is a multi-criteria decision-making method that uses a hierarchy to represent a decision problem. Each element in the hierarchy is supposed to be independent, and a relative scale measurement is derived from pairwise comparisons of the elements in a level of hierarchy with respect to an element of the preceding level. The advantage is that AHP takes into account subtle attribute preferences of the customer that are otherwise difficult to include. In addition, it enables the
incorporation of judgments on intangible qualitative criteria along with tangible quantitative criteria.

Despite its numerous applications and its widespread acceptance, there are at least four issues where AHP is subject to criticism:

1. The foundations of AHP do not derive from a specific mathematical theory.
2. The nine point AHP scale has some obvious shortcomings. The exact ratio scale used in the pairwise comparisons sometimes fails to take into account the imprecision or the vagueness in the mind of respondents when they make the pairwise comparisons.
3. The form of the questions associated with AHP do not provide useful information about the decision-makers' preferences.
4. Although the eigenvalue method is very elegant from the mathematical viewpoint, the priority vector derived could violate the condition of order preservation that is fundamental in decision aiding – an activity in which it is essential to respect values and judgments.

Apart from AHP, the ANP has been used in conjunction with QFD. The ANP generalizes the AHP by replacing hierarchies with networks. AHP employs a unidirectional hierarchical relationship among clusters, while ANP enables interrelationships not only among the clusters but also between the elements of a cluster. ANP is used in the HOQ so as to calculate the correlations between columns in the Roof matrix, and ANP's Supermatrix is used to determine the priorities of service features.

ANP exhibits some important features that promote its integration with QFD:

1. In the traditional QFD approach the roof matrix correlations are employed during the post-analysis evaluation to adjust the column values. However, the use of ANP integrates the roof matrix values into the computations, thereby reducing the amount of subjectivity.
2. The QFD approach treats the column relationships as symmetrical reciprocal correlations. In contrast, ANP treats column correlations either symmetrically or asymmetrically as appropriate.
3. ANP assumes that the relationships between customer requirements and service attributes are not linear and there is inner dependence among customer needs or among service features. This perspective provides a basis to calculate to what extent a change, in one feature will affect the achievement of the others and consequently to what extent it will affect the customer.

Accurate and objective measuring

QFD is an elegant tool that has been successfully introduced to the service sector. It offers a structured guideline for converting customers' requirements into characteristics of new services.

AHP and ANP are well-known quantitative techniques that can be used in conjunction with QFD. However, the integrated QFD-AHP-ANP method entails gigantic data collection tasks. It employs a lengthy questionnaire with numerous and quite similar questions, occasionally causing confusion to respondents. Consequently, it is extremely difficult for customers to make all these pairwise comparisons while the overall procedure requires a lot of time and patience.

Last, while the proposed model adds quantitative precision to an otherwise qualitative method, on the other hand, there are weaknesses and drawbacks of AHP. In particular, at least four main issues regarding AHP criticism were identified.
Still, undoubtedly, the incorporation of AHP in the QFD context provides a more accurate and less subjective measuring framework. The outcome supports better service offerings that meet or exceed customers' needs, leading to improved sales and higher satisfaction.

April 2010.

This is a shortened version of "The application of quality function deployment in service quality management", which originally appeared in *The TQM Journal*, Volume 21 Number 4, 2009.

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