

## Quality Function Deployment

*Marketing Encyclopedia for the Year 2000*, Jeffrey Heilbrunn, Editor  
 American Marketing Association, Chicago, IL 60606  
 (Entry written by John R. Hauser, M.I.T.)

Quality Function Deployment (QFD) was developed in 1972 at Mitsubishi's Kobe shipyard, brought to the United States by Ford and Xerox in 1986 and has been adopted widely by Japanese, United States, and European firms. In some applications it has reduced design time by 40% and design costs by 60% while maintaining and enhancing design quality. QFD helps an interfunctional team of marketing, R&D, manufacturing, and sales work together to focus on product development. It provides procedures and processes to enhance communication by focusing on the language of the customer.

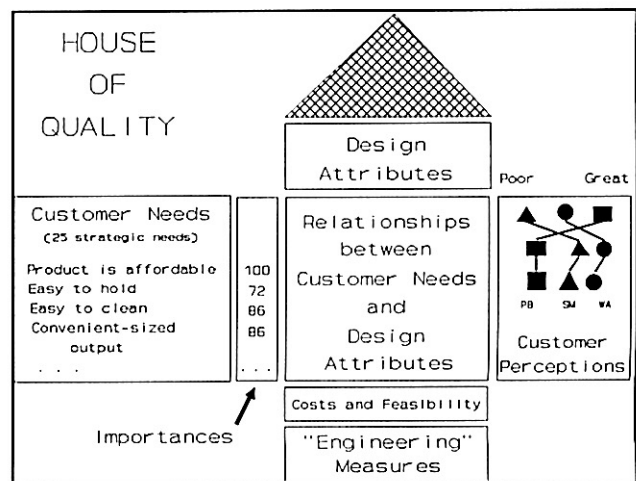
QFD uses four "houses" to integrate the informational needs of the product development team. Applications begin with the first house, the House of Quality (HOQ), which is shown conceptually in figure 1. Together the team uses the HOQ to understand the voice of the customer and to translate it to the voice of the engineer.

### *The Voice of the Customer*

**Identifying customer needs.** A customer need is a description, in the customer's own words, of the benefit which he, she, or they want fulfilled by the product or service. For example, spirometry (a medical instrument for measuring lung capacity) users state needs such as the "product is affordable," "easy to hold," "easy to clean," and provides "convenient-sized output."

Normally, discussions with customers identify 100-400 customer needs including basic needs (what the customer just assumes a spirometer will do), articulated needs (what the customer will tell you that he, she, or they want the spirometer to do), and excitement needs (those needs, which, if they were fulfilled, would delight and surprise the customer). However, it is difficult for a team to work with 100-400 customer needs simultaneously.

**Structuring the needs.** To make customer needs manageable, they are structured into a hierarchy. The primary needs, also known as strategic needs, are generally the five-to-ten top-level needs that set the strategic direction for the product. For example, "easy to use" is a strategic need for spirometry. Secondary needs, also known as tactical needs, are elaborations of the primary needs -- each primary need is usually elaborated into three-to-ten secondary needs. These needs indicate more specifically what can be done to fulfill the corresponding strategic (primary) need. For example, "easy to use" is elaborated to "easy to set up the first



**Figure 1. The House of Quality**

time," "easy to operate," "fast to use," and "easy to calibrate." In most cases the secondary needs are themselves elaborated to very detailed tertiary needs. Such tertiary needs indicate specifically how the design team can fulfill the secondary needs. (For a complete marketing example for spirometry see Hauser 1993.)

**Importances of the needs.** Customers want their needs fulfilled, but some needs have higher priorities than others. These priorities help the QFD team make decisions which balance the cost of fulfilling a need and the benefit to the customer. For example, if it is equally costly to fulfill two needs, then the need which the customer rates as more important should be given higher priority. For example, when designing a spirometer Puritan-Bennett measured importances on a 100-point scale.

**Customer perceptions.** Customer perceptions describe how customers evaluate competitive products in terms of the product or service's abilities to fulfill the customer needs. By understanding which products fulfill customer needs best, how well those customer needs are fulfilled, and whether there are any gaps between the best product and the firm's current product, the QFD team provides goals and identifies opportunities for product design.

### *The Voice of the Engineer*

**Design attributes.** To fulfill customer needs, the product (or service) must fulfill measurable requirements. For example, if a spirometry system provides hard-copy output, then design attributes might include resolution, fade resistance, paper loading time, printing noise, and paper-feed failure rates. These design measures are listed at the top of the house. They are measured in physical measurement units that become targets for an R&D design. However, they are not product solutions. Solutions come in the second house of QFD. If solutions are specified too early, the R&D process becomes constrained to existing solutions. New, creative directions may be missed.

**Engineering measures.** Just as the design team measures competitive products with respect to customer needs, so does the team measure competitive products on the physical units specified by the design attributes.

**Relationship matrix.** The QFD team judges which design attributes influence which customer needs. Each element of the relationship matrix indicates how much (if at all) each design attribute affects each customer need. The idea is to specify the strongest relationships leaving most of the matrix blank (60-70% blank).

**Roof matrix.** Finally, the roof matrix, shown as cross-hatched lines in figure 1, quantifies the physical interrelations among the design attributes.

**Other estimates.** The team often estimates costs, feasibility, and technical difficulty for changes in each of the design attributes.

*QFD in America*

The most definitive study to date on QFD in America (Griffin 1992) suggests that the greatest impact of QFD has been the enhancement of the product development process so that it is more effective in the long term. Product development is most effective when the marketing, R&D, manufacturing, and engineering functions cooperate and when they understand one another. QFD enhances communication by providing the vehicle for communication. QFD enhances market success by ensuring that each of these functions is focused on providing benefits to the customer.

*References*

- Griffin, Abbie (1992), "Evaluating QFD's Use In U.S. Firms as a Process for Developing Products," *Journal of Product Innovation Management*, (September), 171-187.
- \_\_\_\_\_ and John R. Hauser (1993), "The Voice of the Customer," *Marketing Science*, (Winter), 1-27.
- Hauser, John R. (1993), "How Puritan-Bennett Used the House of Quality," *Sloan Management Review*, 34, 3, (Spring), 61-70.
- \_\_\_\_\_ and Don P. Clausing (1988), "The House of Quality," *Harvard Business Review*, May/June, 63-73.
- King, Robert (1987), *Better Designs in Half the Time: Implementing Quality Function Deployment (QFD) in America*, Lawrence, MA: G.O.A.L., Inc.
- Sullivan, Lawrence P. (1986), "Quality Function Deployment," *Quality Progress*, 19, 6, (June), 39-50.