Quality Function Deployment
(Draft)

The Joint Advanced Strike Technology (JAST) Program is employing Quality Function Deployment (QFD) as the tool to support their top-down Strategy-To-Task analysis. By leveraging the attributes of QFD the JAST Program has been able to establish and document the explicit linkage between the needs of the strike "warfighter" and the associated technology solutions to address those needs. Using the QFD approach, JAST has quantified and prioritized the relationships between strategic objectives, strike operational requirements and enabling technology areas. In addition, the approach has been applied to address affordability and return on investment for the set of technology areas under consideration [1].

The JAST Program Office has found QFD to be a very effective tool in the implementation of Integrated Product and Process Development (IPPD). QFD has helped enable the Program Office to build a consensus across a large group of individuals and organizations representing different experiences, operational needs and priorities. QFD has helped JAST provide a common understanding of customer requirements, identify how those requirements are to be satisfied and present the respective relationships between requirements and potential solutions in a structured, easily understood manner.

Introduction

Quality Function Deployment is a team-based technique that provides a means of identifying and translating *customer requirements* into technical specifications for product planning, design, process, and production. The term Quality Function Deployment is a loose translation from the Japanese name for this methodology, *hin shitsu* (quality), *ki nou* (function), *ten kai* (deployment) [2]. The methodology consists of a structured procedure that starts with the *qualities* desired by the customer, leads through the *functions* required to provide these products and/or services, and identifies the means for *deploying* the available resources to best provide these products and/or services.

Research has found that QFD can provide some short-term benefits such as reducing the cross-functional barriers associated with product development teams and aiding changes in corporate culture. However, over the long-term, QFD has been shown to address the more tangible benefits of reduced cycle time, reduced development cost, and increased productivity [2]. An important benefit of QFD has been its effectiveness in capturing, prioritizing and stabilizing customer requirements. As with many business practices, the manner in which QFD is implemented will likely have a significant impact

on the benefits derived [3]. Team commitment to the methodology is an important success factor [3].

Background

QFD has its roots in Japan of the late 60's and early 70's [2]. 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.* By employing this methodology, numerous Japanese companies enabled their product development efforts to more effectively focus on meeting customer needs, thus building a distinct competitive advantage. The successes in Japan helped lead to the adoption of QFD by companies in the United States starting in the early 80's. 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%) [2].

Implementation

The QFD methodology is implemented via the following sequential steps:

1. The *Objective Statement* - identification of the customer, their requirements, and the goal of the QFD team.
2. The *Whats* - identification of the characteristics of the product and/or services desired by the customer.
3. The *Hows* - identification of the ways of achieving the *Whats*.

These steps are applied across the sequential phases of a product/service development cycle: product/service planning, design planning, process planning, and production planning. For each phase, a matrix is used to map from the desired characteristics (the *Whats*) to the options for meeting these characteristics (the *Hows*), see figure 1 [2,4] . For example, in phase 1 the *Whats* are the customer requirements and act as the matrix inputs. The matrix outputs for phase 1 are the product/service design specifications, the *Hows*. These phase 1 matrix outputs, the *Hows*, in turn become the phase 2 matrix inputs, the *Whats*, see figure 2. This sequential approach continues, resulting in production requirements as the outputs, or *Hows*, of phase 4.

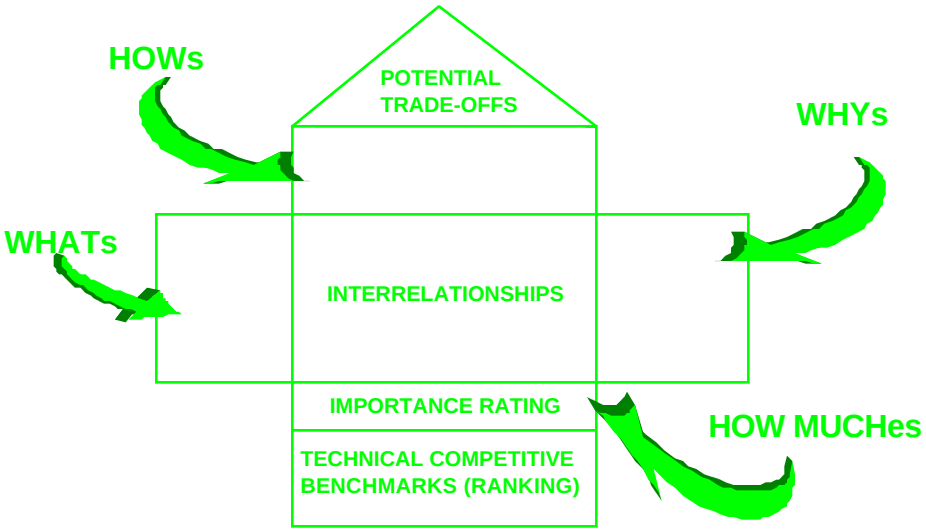

Figure 1. Quality Function Deployment Matrix

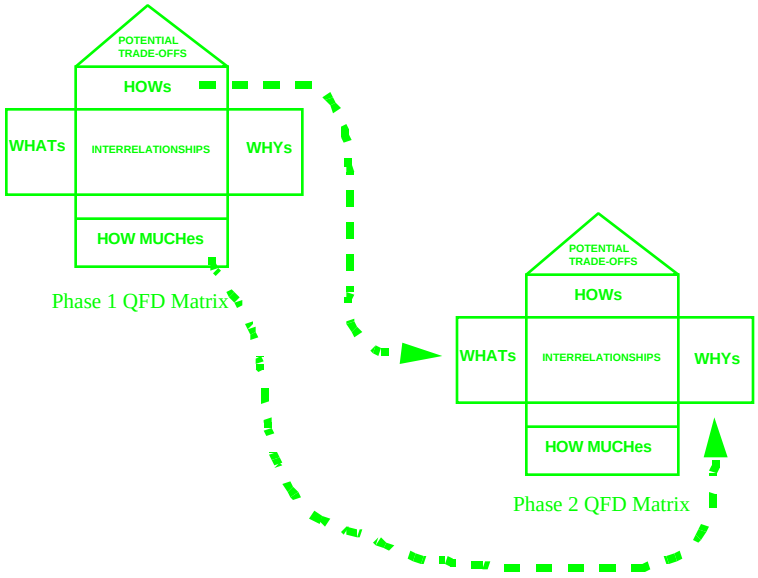

Figure 2. QFD Matrix Flowdown

Throughout this multi-phase approach, all of the team members (design, manufacturing, marketing, etc.) are able to see how their inputs contribute to satisfying customer requirements, thus helping to overcome the walls between these functional areas in the product development process. In addition, since all decisions are systematically linked back to customer requirements, QFD-based decision making will be more directly based on the customer's priorities versus being suboptimized at functional or other levels.

Employing QFD leads to collecting all data required to generate good product definition, design, process, production and delivery decisions early in the process. It presents these data in a highly visible and compact form, which can quickly communicate the overall plan. It acts as an effective repository of the planning decision-making. And, it also identifies areas where additional decision-making information is required.

Deciding to use QFD

QFD is a powerful tool that can lead to significant improvements in product and process performance. However, like most tools, it is not the answer for every job. Although QFD has the potential to meet the product development objectives of shortened cycle time and reduced cost, it is not a short-term answer to product development problems. QFD is one technique program managers should have available for consideration in application to their program.

As part of their decision-making criteria for adopting QFD, program managers should trade off whether the impacts of short term benefits will be strong and visible enough to allow the organization to keep investing in using the process until measurable effects on reducing cycle time and development cost can be realized. QFD provides a systematic approach to build a team perspective on: what needs to be done, the best ways to do it, the best order in which to accomplish it, and the staffing and resources required [2,5]. It also provides a good format for capturing and documenting decision making.

The manner in which QFD is implemented may have a large impact on the benefits derived and thus managers should be reluctant in pushing QFD on their teams without their consent and commitment [3]. QFD can also be introduced in a bottom-up manner by a product team member, or by another neutral party, such as the Quality Assurance Group. When all the team members and their management are committed to QFD as a means to achieve a specific goal, and when they and upper management treat the time, energy and money spent on implementing the process as an investment in the product and team, QFD may provide the significant benefits identified.

QFD in DoD

The JAST Program Office has used QFD extensively in support of its top-down requirements analysis. McDonnell Douglas provided the QFD training to JAST personnel and supports the facilitation of the QFD implementation. McDonnell Douglas has provided similar QFD support to other DoD programs, and offers QFD training both internal and external to their organization.

The points of contact for QFD are:

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Summary

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