



IDENTIFYING CUSTOMER REQUIREMENTS THROUGH QUALITY FUNCTION DEPLOYMENT PHASE I: FEASIBILITY STUDY

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Printed in the United States of America.

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Chapter 1

EXECUTIVE SUMMARY

Quality Function Deployment (QFD) is a planning and communication tool of proven value in manufacturing and service industries, in the design of new products and services and the improvement of existing ones. Appendix A contains more complete descriptive information on QFD.

This research was commissioned by the Construction Industry Institute (CII) to determine the feasibility of adapting QFD for use in the project management process of the engineering and construction (E&C) industry. The findings are clear:

Quality Function Deployment has definite value as a tool for improving the project definition process.

It has step-change potential for use by both Owners and Contractors.

The benefits are concentrated in the areas:

- *Enhanced identification of, and response to, customer requirements.*
- *More complete up-front planning.*
- *Reduced cycle time, through less redesign.*
- *Better cross-functional communication.*

The Engineering and Construction Challenge

Project definition – the "scope problem" – is generally cited by engineering and construction (E&C) practitioners as the single, greatest source of poor efficiency in the overall interaction between owner and contractor, as measured by false starts, rework, disputes, claims, and litigation. There is no commonly accepted method used in the industry.

One of the conclusions of the Business Roundtable's *Construction Industry Cost Effectiveness (CICE) Study* (2) was that:

"Poor scope definition at the estimate (budget) stage and loss of control of project scope rank as the most frequent contributing factors to cost overruns."

Succeeding research by the Construction Industry Institute (CII) (4) found that "... when there is poor scope definition, final project costs can be expected to be higher because of the inevitable changes which disrupt project rhythm, cause rework, increase project time, and lower the productivity and morale of the work force."

QFD's Strengths

This research produced observations about the results of using QFD, which can easily be related to the project definition problem:

- A highly effective planning tool.
- Significant payoff when used to achieve breakthrough changes in areas of deficient or critical customer satisfaction.
- A method for more precisely defining the "it" in "Do it right the first time." Produces a more rational set of design decisions, and highlights potential conflicts early in the design process.
- A structured approach to handling critical and complex sets of requirements.
- Reduction of cycle time through reducing redesign and improving inter-functional communication.
- Effectiveness in breaking down barriers among people and organizations.

How Owners Would Benefit

Owners generate projects and benefit from the accomplishment of project objectives. They therefore have the ultimate stake in finding improved methods for project planning. Potential planning benefits which might accrue from the use of QFD include:

- Optimum internal definition of project requirements, coordinating such diverse considerations as market timing and financial, technical, production, and maintenance inputs.
- More efficient communication of the requirements to the design/construction contractor(s).
- Shorter cycle time from project concept to startup.
- Greater conformance of project execution to project requirements.

How Contractors Would Benefit

Although the owner bears the final brunt of inefficiencies in project planning and execution, the E&C contractor experiences severe disruption to its own business stability when such problems occur. The contractor should experience the following benefits from using QFD, in conjunction with a knowledgeable owner:

- A standard approach to obtaining and using the owner's requirements.
- A more complete set of owner requirements, and a more complete understanding of them.
- Fewer conflicts in design requirements.
- Less rework, leading to lower costs and shorter project execution time.
- Greater opportunity to integrate constructability concepts into the design.

What is Lacking for E&C Implementation of QFD

QFD is a relatively new tool in the set of methods available to U.S. companies for improving quality and productivity. It has not been widely used in the E&C industry, and therefore there exists no widely understood "application framework" by which firms can understand the technique and how it might be applied in the project management process.

Recommendations

The TQM Task Force recommends that the Construction Industry Institute fund a follow-up project to define an application framework for implementing QFD in the E&C industry, incorporating the following main features:

1. A focus on application of QFD in the **project definition phase**.
2. A practical, **working model** of the QFD technique, developed with the assistance of two owners and two contractors, preferably CII member companies who have some QFD experience or knowledge. Details of the model are outlined below.
3. Application guidelines for owners' and contractors' internal use, as well as for joint owner/contractor use.
4. Guidelines for integrating QFD with current methods of project definition, where such would be constructive.

The E&C application framework, or working model, would define the following:

- How to set up the QFD project, including fitting it to an appropriate E&C project and scoping the QFD effort.
- How to form the QFD team, including team composition, chartering, training, facilitation, and logistics.
- How to structure the QFD graphic aids (the "House of Quality" and other matrices).
- The requirements for pre-QFD setup and "homework" to be accomplished by each party, owner and contractor.
- How to organize the initial input, the owner's requirements and the contractor's technical capability, for most efficient QFD processing.
- How to conduct team meetings: objectives, agendas, team assignments, follow-up tasks, etc.
- How to complete and interpret the QFD matrices.
- How to use the QFD output over the remaining life of the project.
- How to provide for ongoing QFD process ownership and facilitation.

Figure 1.1 gives a more complete description of the E&C application framework.

The Phase II project could be completed by early 1993, assuming approval and contract execution by June 1, 1992. Preliminary work on the model would proceed during the period January–May 1992, independent of CII funding. The CII-funded portion would carry this preliminary development to at least two CII owners and two CII contractors for detailed development and evaluation by the individual companies, and finally in a workshop setting attended by all the participating companies. The preliminary and detailed design of the model would be accomplished via limited-scope, low-risk pilot applications in the participating firms. Such would produce "real time" development and feedback, thus maximizing the Phase II output and making it ready for use by interested companies in a comparatively short time period.

A Phase II project proposal to CII accompanies this report.

Figure 1.2 is a preliminary deployment flowchart of the Phase II project.

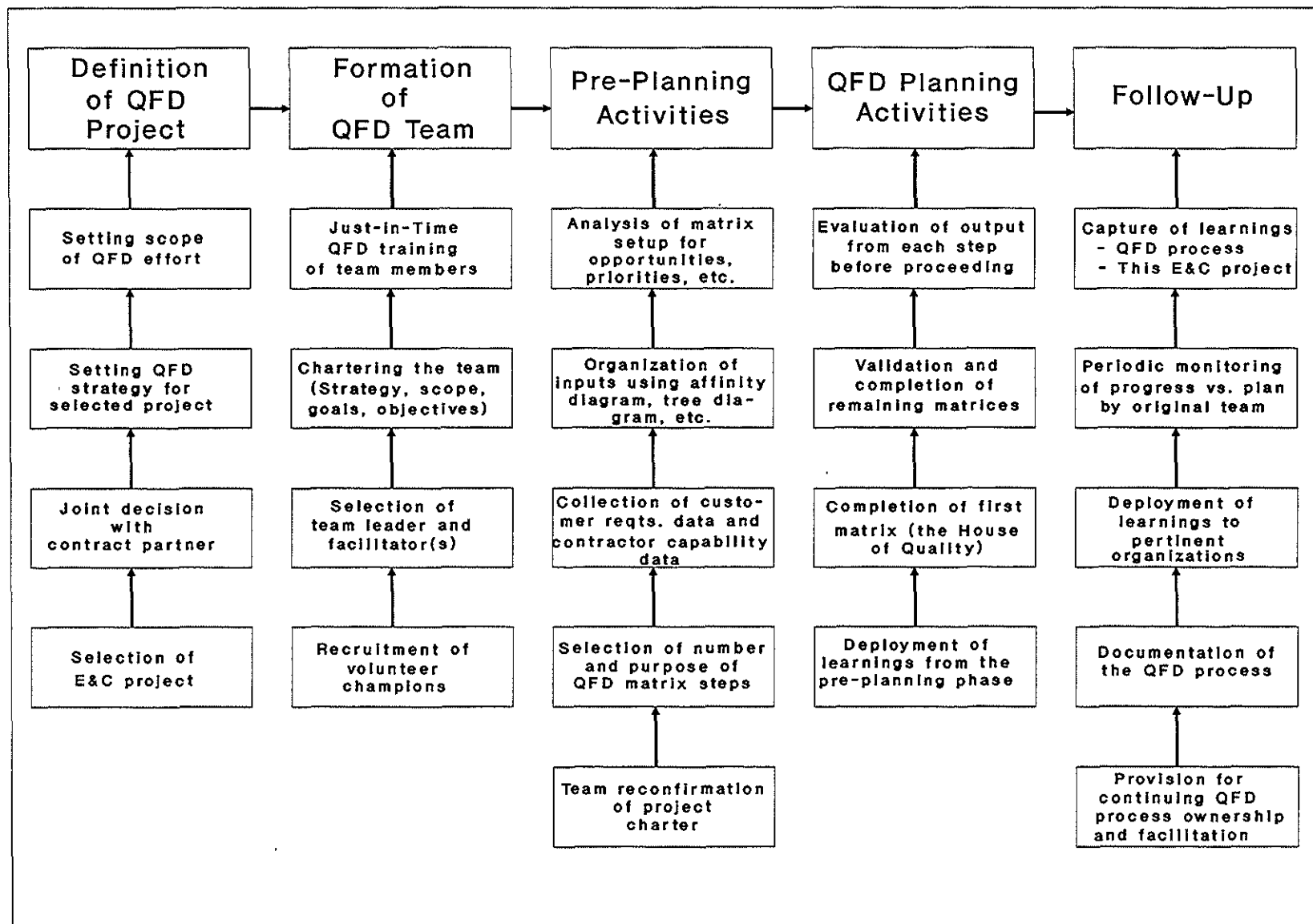


Figure 1.1 Application Framework for QFD Use on E&C Project

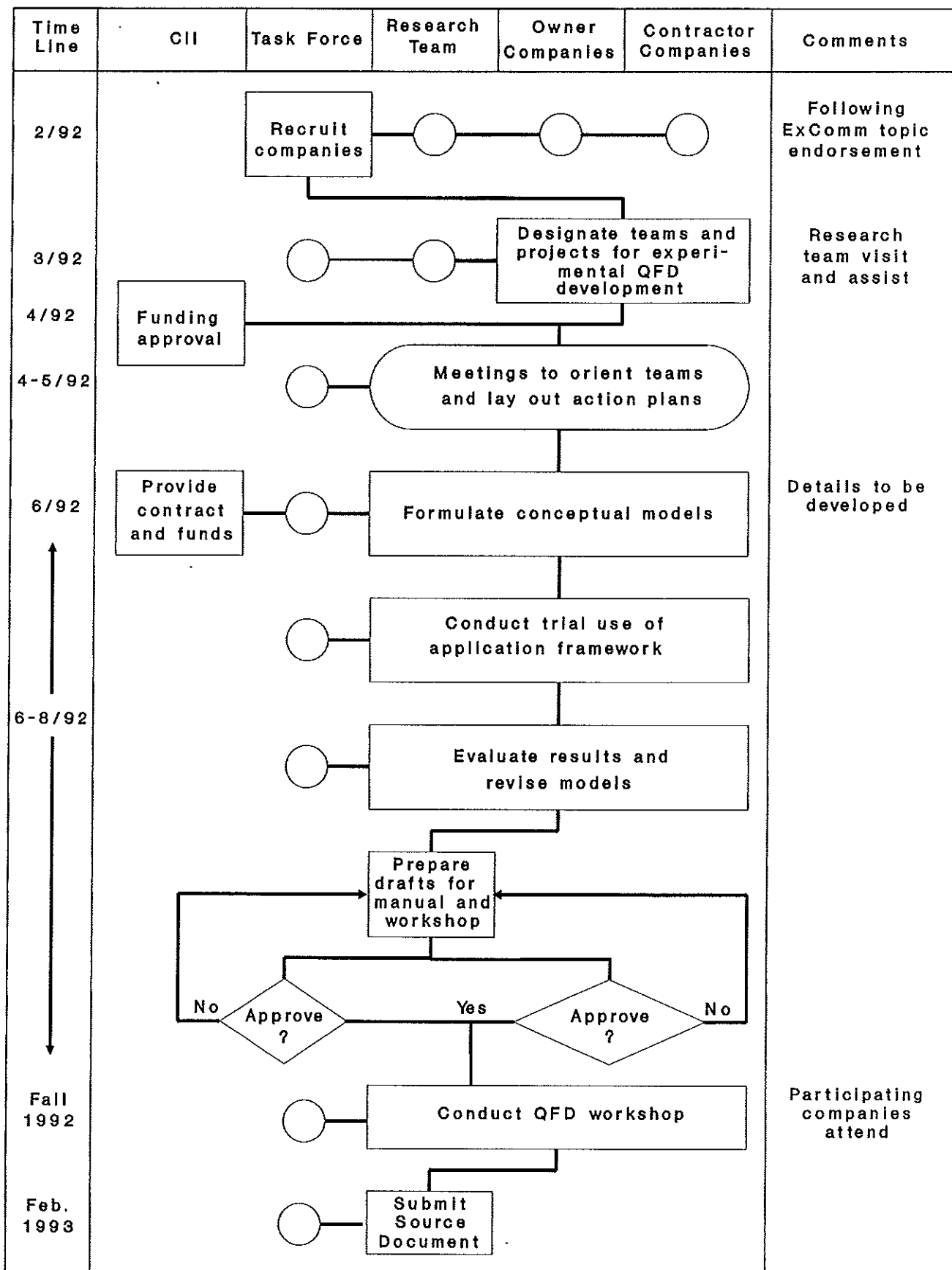


Figure 1.2 Phase II QFD Project Schedule



Documents

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Chapter 2

RESEARCH FINDINGS

The research team visited four companies that were identified as having made extensive use of QFD. Three companies were engaged in manufacturing, and one was service oriented. Table 2.1 indicates the main type of business represented by each company. Company identities are not revealed, in accordance with CII's policy on confidentiality.

Table 2.1 Companies Interviewed

Company Code Number	Type of Business
1	Consumer products, non-durable
2	Consumer products, durable
3	Service
4	High-tech systems and consumer durables

Appendix B provides an overview of the research methodology.

Literature Search

No significant discussion of QFD, as related to the E&C industry, has yet occurred in the literature. Appendix A contains references to articles and papers on QFD in other industries.

Interviews

The information obtained from company interviews is presented in Tables 2.2 through 2.11 under the general headings:

- Reasons for Adopting QFD
- Uses of QFD
- Implementation History
- Capturing Customer Requirements
- QFD Teams
- Training
- Results of Using QFD
- Success Factors
- Barriers
- Advice Concerning QFD Implementation

For each topic, the interview findings are summarized separately for each company, with the key learnings from all four companies extracted and summarized in the second part of the table. The key learnings are numbered serially within each sub-topic for use in Chapter 3, where they are cited as relevant to the respective E&C implementation issues.

Table 2.2 Reasons for Adopting QFD

Co.	Information from Interview
1	● Wide variation in product quality and quality objectives. ● Had no way of weighting quality attributes and performance against those attributes. ● Needed to align product standards across the company.
2	● International competition; loss of market share. ● Rising customer expectations. ● Increasing government regulation. ● Productivity disappointments. ● Need for top-down systems approach to new product development, rather than produce-test-correct approach.
3	● Recognition that business gains come from process improvement. ● Used TQM for continual improvement. QFD and Taguchi loss function adopted for use in bringing about more radical change.
4	● Part of company's system for process quality management and improvement.

Key Learnings
2.2.1 Motivations for adopting QFD are similar to those supporting TQM.
2.2.2 QFD motivation is centered on designing processes and products for maximum responsiveness to customer needs.
2.2.3 The need for cycle time reduction to keep pace with competitors is a key driver.

Table 2.3 Uses of QFD

Co.	Information from Interview
1	● Based on the business objectives of the company. ● New product development as well as improvement of existing products. ● Chain of QFD phases (matrices): Customer demands vs. design requirements, and on to part characteristics, key process variables, and production requirements.
2	● Concentrate on areas of competitive deficiency and most critical areas of customer satisfaction. ● Apply QFD on wide variety of projects from strategic and financial planning to major manufactured systems, to components, to parts, and to raw materials. ● Extensive, joint use of QFD with suppliers.
3	● Use QFD to accomplish "breakthrough" improvements in service processes. ● Consolidation of customer service points into a single new department.
4	● QFD is used at all levels of detail. ● Hardware and process design and improvement. ● Software development. ● Service definition. ● Establishing 5-year plans.

Key Learnings
2.3.1 The basic technique of QFD is to facilitate the comparison of a number of requirements (inputs) to a set of potential responses to those requirements (outputs). 2.3.2 QFD can be used in a wide variety of situations: Either "hard" or "soft" products. Developing new products/services, or improving existing ones. Large, complex systems, or small component parts. 2.3.3 QFD's greatest payoff comes when it is used to achieve breakthrough changes in areas of deficient or critical customer satisfaction. 2.3.4 Building the voice of the customer (VOC) into the early design phase can avoid later rework which would actually lengthen cycle time.