Modern QFD[sm] in North America: 2005 Update, Twenty-One Years of Practical Application

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Abstract

QFD was introduced in North America in 1983 and was quickly picked up by the then struggling auto industry. By 1985, US practitioners were already spreading the method to other industries and the first practical applications appeared. Successful at first, new QFD applications began to slow by the early 1990s as downsizing by North American companies made it difficult to devote adequate manpower, time, and money to do exhaustive studies. This paper will describe the renaissance of QFD practice since 1993, especially as it relates to changes in methodology and tools to accommodate the need for speed. It is referred to as Modern QFD[sm].

Introduction

Dr. Akao introduced QFD into North America in 1983 with his article in Quality Progress [1] and workshop sponsored by Masaaki Imai's Cambridge Corporation (now called Kaizen Institute).[2] In 1984, two influential leaders in the quality field, Robert King of GOAL/QPC and Larry Sullivan of the American Supplier Institute (then Ford Supplier Institute) visited Dr. Akao and others in Japan to learn how to practically apply QFD in industry. Thus, began a rapid rise in the use of QFD and adoption by numerous industries. Several papers have chronicled the next ten years of QFD's success and acceptance;[3,4,5] and this paper will illustrate more substantially what has gone on specifically in North America.

QFD legacy

The automotive and other industries struggled in the early 1980s to improve their understanding of their customers, improve their designs, and to improve their processes. QFD was one of the driving forces that led to adoption of other Total Quality Management methods, ISO 9000, QS-9000, Malcolm Baldrige National Quality Award, Advanced Product Quality Planning (APQP), etc. Since many of these tools came from Japan, they required an unspoken commitment to do the job thoroughly, no matter how great the effort. While Japanese companies used the newly found efficiencies to broaden their markets and product offerings, many North American companies used efficiency improvements as cut labor costs resulting in downsizing not only production labor, but eventually engineering manpower, as well. This "right-sizing" had the effect of making time-consuming quality methods, like QFD, nearly impossible to complete.

QFD Institute solutions

By 1993, GOAL/QPC and ASI had refocused their research and training efforts on new topics such as creativity and innovation. Sensing a need to sustain QFD's momentum, three of GOAL/QPC's main instructors, the author, Richard Zultner, and John Terninko (who also taught for ASI) formed the QFD Institute with the mission of advancing QFD in North America. Richard Zultner, working with software development clients, helped resurrect some of the earliest QFD models based on cause-and-effect diagrams [6]. Using spreadsheets that were easier to manipulate that fishbone diagrams, he created the Maximum Value Table to more efficiently deploy critical customer needs than could be done using traditional matrices like the House of Quality. He dubbed this "Blitz QFD®" and the QFD Institute began to offer it as a tutorial at the annual Symposium in 1996 [7]. Time-sensitive industries such as software development quickly embraced this time-saving approach, but its matrix-free approach made it difficult for other QFD practitioners to adopt.

QFD Belt training

About this same time, General Electric and Motorola began efforts to make their TQM activities faster, more standard, and better trained. Alluding to the achievement levels used in martial arts, they began to promote Six Sigma Green Belt and Black Belt training as a way to assuring best practices in their companies. In 1999, Dr. Akao began worrying about the quality and quantity of QFD applications in the US as represented in the papers being presented at the US and international conferences. In 2000, he challenged Mazur and Zultner to revitalized QFD efforts and awarded them Certificates of QFD Mastery [8] to authorize their modernizing of QFD to be faster, more standard, and better trained. Since QFD was already named as a required methodology in Six Sigma, the QFD Institute decided to use similar terms to describe its new Modern QFD[sm] courses. Most Six Sigma training covers only Traditional QFD (House of Quality plus 3 other matrices) which was optimized for auto parts suppliers building to OEM supplied prints and specifications. To be efficient, Modern QFD[sm] must be custom tailored to the reality and environment of each company's products. If both products and services are offered, then there may be two approaches to QFD. Companies with broad product divisions, such as pharmaceuticals and electronics, may find that more than one QFD approach is needed. While the QFD Institute offers some of these courses to the public in a generic format (untailored), these are mostly for companies that wish to experience the program before bringing it in-house.

Here is a brief description of the levels currently offered [9]. To protect the integrity of the Modern QFD[sm] Belt program, these names have been registered as Trademarks of the QFD Institute in North America, Europe, and Asia.

QFD White Belt®. A one-day introduction to the theory of QFD, accompanied by case studies. This is for companies that want to build interest in QFD, but are not yet ready to invest more time.

QFD Technical Review. This is the heart of the custom tailoring process. Key product development process owners representing marketing, sales, R&D, design, engineering, manufacturing, quality, production, service, etc. are interviewed to learn about where QFD is most needed. The process, tools, and sequence are then custom tailored to these needs and case studies prepared.

QFD Gold Belt®. This program addresses the role of senior management in QFD. The custom tailored QFD process is presented to executives, especially focusing on the deliverables and required inputs and support necessary to achieve those deliverables. Areas such as business strategy, project selection, and project objectives are developed. Following the completion of the second QFD Black Belt® project, a follow up session reviews the forecasted deliverables and actual results, next steps, and other issues pertaining to successful integration of QFD into the everyday fabric of the company.

QFD Green Belt®. The tailored process and tools are then practiced in a two-day class-room atmosphere so that participants can learn the method in a safe environment. Two work objects must be completed and approved by the instructor to receive a full status certificate.

QFD Black Belt®. Application to a real project is necessary to really learn the tailored process. The training is delivered in short modules as the project progresses, with field work and support between the modules. After completion of the first project under the guidance of the instructor, team members must facilitate a second project on their own and submit the work for approval to achieve full status. Optionally, they can elect a train-the-trainer course and teach and certify their own QFD Green Belts® in their tailored process.

QFD Master Black Belt®. The key to an efficient and effective QFD process is doing only those activities that add value to the product and the work of the product development team. In many cases, there is no time for anything else. Thus, custom tailoring the QFD process to the realities of an organization is imperative in today's fast paced, resource constrained business environment. The QFD Master Black Belt® undergoes rigorous training through analysis of case studies to learn

how to tailor QFD for a wide variety of situations. Once they have achieved full status, the QFD Master Black Belt® can custom tailor, train and certify QFD Black Belts®, QFD Green Belts®, both public and in-house, and conduct QFD White Belt® and QFD Gold Belt® sessions.

Table 1. 2000-2005 Belts Awarded	QFD Green Belts®	QFD Black Belts®
Australia	38	
Canada	26	
India	138	54
Italy	12	
Germany	9	
Luxembourg	14	7
Mexico	168	110
New Zealand	34	18
Peru	26	
Switzerland	24	
Turkey	65	
UK	9	1
US	1085	228
TOTALS	**1648**	**418**

Improvements to Traditional QFD

Voice of Customer. In the beginning, QFD was primarily a quality assurance approach to facilitate and improve communication of critical control points from manufacturing to production. Under Dr. Akao and others' guidance, it has moved upstream to include design, marketing, strategy, and now information and knowledge management. Full and accurate understanding of true customer needs began to emerge as marketing activities were brought into the fold. Several of Japan's top QFD experts brought these second generation methods to the US in Kaizen Institute of America sponsored courses taught by Tadashi Ohfuji and Michiteru Ono in the late 1980s (all were attended by Mazur and Zultner), and by Satoshi "Cha" Nakui who led GOAL/QPC's QFD Research Sub-committee from 1990-1993 (members included Mazur, Zultner, and Terninko) and through ongoing instruction until his return to Japan in 1996. Among the various tools included tables to analyze and translate customer verbatims and behavior into true customer needs.[10] Customer need was also more clearly defined as a customer problem, opportunity, or image issue, independent of the product or technology. For example, a verbatims such as "I want a hot cup of coffee" is not a customer need because it describes the product, hot coffee. The verbatim must be translated into a clear statement of a customer problem or opportunity, such as "I want to feel warm," "I want to be more alert," etc. Because there are other ways in which these needs can be fulfilled, the designer's degrees of freedom are opened to more innovative solutions.

Blitz QFD®. By combining the voice of customer analysis tools with the Maximum Value Table, we have a very fast approach to solving the few most critical customer needs, end-to-end through the entire business process. For many projects, this is all the QFD the team will be able to complete due to time and resource constraints. The guiding principle is that the customer is better served by completely solving for his few critical needs then attempting and then abandoning midstream only a House of Quality.

QFD Math. QFD is a required method in many Six Sigma and Design for Six Sigma programs. Six Sigma is rich in statistical tools to provide the accuracy necessary to achieve 3ppm levels of quality. It is time, then, that QFD practitioners address the issue of the numerical inaccuracy of the QFD matrices. Historically, QFD began at a time when even four-function calculators were rare. Early Japanese practitioners made their charts manually and often used the letters a, b, c to determine importance and other measures. When simple calculators became available, numbers became easier to manipulate and so were used more and more. Since customer needs and functional characteristics had different scales of measurement, it was hard to compare them, and so a simple 1-5 rating scale was adopted to keep all the data in a comparable scale.

The problem is that this 1-5 rating scale is an ordinal scale. Even the QFD operations performed in the Quality Planning Table, such as the Customer Importance and Competitive Assessments are faulty. Is a rating of 4 twice as important as a rating of 2 for all the customer needs, or could it be different? With an ordinal scale we cannot tell. The Improvement Ratio where we divide the Plan by the Current level is also improper math because you cannot divide ordinal scale numbers.

The Sales Point, too, is an ordinal scale, and it is equally invalid math when we multiply the Customer Importance x Improvement Ratio x Sales Point to calculate the Absolute Weight and Customer Needs Weight because multiplying ordinal scale numbers is also invalid. Then, we multiply the Customer Needs Weight by the Relationship Strength (1, 3, 9 is also an ordinal scale), and then sum and divide again for Functional Characteristic Weights. Can anybody really know what these weights mean?

To increase the accuracy of QFD numbers for better Six Sigma compatibility, we must use ratio scale numbers. A method exists and has been used in QFD since the late 1980s. It is called the Analytic Hierarchy Process or AHP for short. It was developed by Dr. Tom Saaty [11] and is one of the most rigorous tools used in Modern QFD[sm]. Dr. Akao and others [12] began promoting it in their lectures in the late 1980s but Americans (except Zultner) were slow to pick it up because it looked complex and we did not realize how inaccurate the Traditional QFD math was. The AHP has added benefits in that it can capture priorities using natural language comparisons and convert them into ratio scale numbers. The process can be done with a calculator, a spreadsheet, and even with dedicated software.

Inclusion of Psychological Needs by integrating Kansei Engineering

More and more, quality has become pervasive throughout the global marketplace. Simply put, products with inadequate quality are unable to sell as high quality, low cost products are widely available. In other words, we are moving to a “commodity” marketplace where quality meets expectations and competition is mainly by moving to low-cost manufacturing locations in order to lower price. How then can a high cost-of-production country compete? One way is to include fulfillment of psychological needs (fashion, image, impression, etc.) in addition to the functional needs. The concept is not new, as traditional Value Engineering has always included “attraction” as a basic function of a product. Kansei Engineering, originally developed by Dr. Mitsuo Nagamachi
in conjunction with Mazda Motors, goes farther in that it can predict what design elements convey various emotional and psychological meaning to the product’s user and to those the user wishes to impress. The author has recently facilitated projects involving the design of off-road vehicles, aircraft interiors [13], and clothing fashion trends. In Modern QFD[sm], this is also called Lifestyle Deployment.

Conclusion

The QFD Institute is dedicated to applying QFD to improve its programs and techniques. In response to customers (the QFD practitioner in companies and Six Sigma Master Black Belts), improvements to the basic process and tools are constantly being made. For current QFD Belts, we also offer update courses at the annual North American QFD Symposium, including the latest training materials and CD-based templates. After all, if we expect our students to apply QFD well, we must show by example.

About the author

Glenn Mazur has been disseminating and instructing QFD methods since their first introduction into the US in the mid-1980s. His work as been recognized by the founders of these methods, being awarded the Akao Prize® in 1998 and being selected as one of only two non-Japanese QFD Red Belts® (highest level) in 2000. His current positions: President of Japan Business Consultants, Ltd., Executive Director of the QFD Institute (volunteer) and International Council for QFD (volunteer), Chairman of the North American Symposia on QFD, and Faculty of TQM at the University of Michigan College of Engineering (retired). Affiliations: Senior Member of American Society for Quality and Japan Society for Quality Control. Email: glenn@mazur.net

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