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Quality Function Deployment (QFD) in TQM and its Future Issues



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Introduction

Recently, Americans have been active in using the quality function deployment (QFD) method. Chrysler's Neon, priced at 1.01 million yen, in January 1994 made headlines in various newspapers as the "Japanese car killer." In June 1996 the right-hand drive Neon was put on the market in Japan, and one of the newspapers wrote, "In 1987 and 1988, Chrysler, under the leadership of its former Chairman Lee Iacocca, made a thorough study of Honda Motor Co., Ltd. As a result, Chrysler reviewed its system, comprising development, production and sales divisions that operated separately, formed a team of representatives from the three divisions in developing a new car model, and had the team work in the same building. This significantly reduced the time required for development and the Neon was completed in only 31 months."

No further report was made to the general public, but the team formed at Chrysler was a QFD type. This was announced by Mr. G. H. Mazur at the 4th QFD Symposium held in 1994 by the Union of Japanese Scientists and Engineers (JUSE). Mr. Mazur's paper, "Arrival of Quality Function Deployment in North America and its First Ten Years," which was published in *Standardization and Quality Control*, provided a detailed description of how QFD had developed and spread in North America since 1983.

Mr. Tsukasa Shinohara, a reporter for Nikkei

Mechanical magazine, being greatly interested in Mr. Mazur's presentation, later researched the American Big Three firsthand and made a detailed report in a feature article, "American Automobile Manufacturers Revive through QFD." US automobile makers were revitalized through the introduction of not only QFD but also total quality management (TQM). But it is considered that QFD played a major role in the revival of America's automotive industry.

In this month's issue, I shall discuss the role that QFD plays in TQM, the status of implementation of QFD in Japan and other countries, and future issues for QFD.

TQM and QFD

Today, in TQM, companies are going all out to develop new products in an effort to stay in business. But unfortunately, when speaking of quality control (QC) in general, many still have the notion that QC affects mainly the manufacturing industry. Or there is a misunderstanding that TQC means to promote QC circles on a company-wide scale. In an attempt to turn a profit and survive, enterprises are striving to develop highly profitable and marketable products and this is where TQM now stands in Japan.

QFD emerged as a method, or idea, for developing new products under total quality control (TQC) during the latter half of the 1960s when Japanese enter-

prises broke away from the age of imitation in the postwar period and started to develop products of their own. Quality Function Deployment, edited by the late Professor Shigeru Mizuno and myself and published in 1978, had the subtitle “An Approach to Company-wide Quality Control,” and emphasis has been placed on development of new products in TQC ever since. A survey of the areas requiring future emphasis in TQM, as conducted at the Quality Control Symposium held in 1995 under JUSE sponsorship, highlighted the importance of “development of new products” and “strategic policy management.” Accordingly, it is considered that QFD, an idea and method for promoting the two, will play an increasingly vital role in TQM.

After World War II statistical quality control (SQC) was introduced to Japan from the United States and quality control was conducted mainly in the manufacturing industry. In 1954 Dr. J. M. Juran emphasized quality control as part of business management. Japan’s harbingers in quality control, including Dr. Kaoru Ishikawa, called for corporate executives to promote “quality control by everyone.” In 1961 “Total Quality Control (TQC),” authored by Mr. A. V. Fiegenbaum, was published in Japan. In the wake of it, through a transition period spanning the first half of the 1960s, SQC shifted to TQC.

It was during this period, when our nation’s automotive industry grew rapidly with new types being developed and cars experiencing continual model changes, that I proposed QFD. The concept of QFD was inspired by two factors:

- (1) Emphasis moved toward design quality but no explanation was given as to how to control the quality.
- (2) QC process charts enjoyed use but were prepared at the jobsite only after new products were brought in.

Once design quality was determined, there should be priority points in quality assurance to secure design quality. I had doubts about why such priority points could not be indicated at the jobsite in the form of control or checkpoints shown in QC process charts prior to the start of production.

Mr. Kiyotaka Enkai of Bridgestone Tire Co., Ltd., in 1966 published a table of process assurance points which linked everything from true quality to process factors. Taking a hint from his table, I thought that if it was used, QC process charts could be prepared before production began. So I added a new column of viewpoints on design to the table and worked to

apply this innovative QC process chart to new product development.

I recommended to various firms that they use this new QC process chart on a trial basis, but time passed without arousing public interest. In 1972 I assembled the expertise I had gained and published a paper using the term “quality deployment” for the first time and describing a way to deploy quality-assurance priority points throughout processes as a means to secure design quality prior to the start of production. Unfortunately, the method still was not enough.

But the problem was resolved by a quality chart proposed by the Kobe shipbuilding yard of Mitsubishi Heavy Industries Co., Ltd., following publication of my paper. The chart systematized true quality (as required by the customer) among functions, and the relationship between functions and quality characteristics (substitute characteristics) was clearly shown. The chart was developed under the guidance of Prof. S. Mizuno and Prof. Y. Furukawa.

These factors were combined to form quality deployment (QD). QD is defined as “to convert the user’s requirements into substitute characteristics (quality characteristics), set design quality for finished products, and systematically deploy the relationships among the quality of various functional parts, the quality of individual parts, and process factors.

Another stream of thought that originated from value engineering (VE) can be found in QFD. Mr. Katsuyoshi Ishihara expanded the idea of product functions in VE to that of operation functions. Later, this idea of operation function deployment led to that of quality function deployment in its narrow sense. Prof. Mizuno defined this as “to deploy job functions or operations forming quality in detail step by step along the purpose-means system.” This is useful in preparing tables of quality assurance activities, one of the forms used in a quality assurance system. When combined, QD as mentioned above and QFD in its narrow sense are generally called QFD in its broad sense.

QFD has evolved into its present form with the addition of QD, wherein quality assurance control points are identified, and QFD in its narrow sense that includes a stream of thought as originating in VE.

During the time of transition from SQC to TQC, autonomous control improvement activities called QC circles began at jobsites. Quality control in Japan evolved into company-wide activities in which all personnel from top executives to front-line employees played a strategic role. In 1969 the world’s first Conference on Quality Control assembled in Japan. At the 9th

Quality Control Symposium, held prior to the Conference, participants decided to call TQC in Japan company-wide quality control (CWQC),” since Japanese TQC differed from the American variety. They also cited six features as unique to CWQC:

- (1) Participation by everyone in the organization
- (2) Education and training in QC
- (3) QC circle activities
- (4) QC diagnosis
- (5) Effective use of statistical methods
- (6) Nationwide QC promotion.

TQC in Japan contributed to overcoming the dollar shocks of 1971 and 1972, the oil shocks of 1973 and 1979, and the greatest postwar test of high yen value in 1976. This hectic era saw great improvements in TQC, and quality assurance systems, including the idea of reliability introduced from America, were established.

The decade of the 1980s is described as the period in which TQC developed and made outstanding progress. At the 44th Quality Control Symposium, which preceded the International Conference on Quality Control held in Tokyo during 1989, the participants reviewed the features of TQC again and added four to the original six:

- (1) Thorough emphasis on quality in corporate management
- (2) Policy deployment and management
- (3) Quality assurance activities that cover all processes from planning and development to sales and services
- (4) Expansion of TQC from the manufacturing to other industries

QD is cited as a specific method for promoting the quality assurance activities described in (3) above. This was recognized from the fact that American TQC called for the establishment of systems around staff members only, with top executives and jobsite workers excluded, while in Japan representatives from all organizational layers, including senior directors, the heads of departments and sections, staff members, jobsite leaders and QC circle members, were educated and trained in QC both within and outside the company and all assume responsibility for quality assurance.

Various business administration techniques recently have been brought from the United States, making corporate Japan confused. This issued from American efforts to catch up with and surpass Japan since NBC in 1980 telecast its show “If Japan can, why can’t we?” Since first introducing QFD to the United States in 1983, I have gone there every year to lec-

ture on Japan’s TQM and QFD, and each trip made me realize more and more that Americans were making progress in TQC.

A prize system like the Malcom Baldrige National Quality Award, concurrent engineering, the lean production system, and other techniques were transferred to the United States from Japan and restructured there. It might be considered that the American concept of customer satisfaction and reengineering as described in the following paragraphs were developed under the influence of Japan. It is important to recognize that steady implementation of business administration with quality as its core, or Japanese TQC, is most needed today. At the same time, emphasis is being placed on the importance of restructuring and development under the new concept of TQM.

It is especially hoped that in the future QFD will help develop new products based on strategic planning and will evolve as a way to create more appealing merchandise.

The Current Status of QFD in Japan and Other Countries

Figure 1 shows the outcome of a survey conducted by the quality deployment study group of the Japanese Society for Quality Control. The results describe year-to-year changes in the number of papers on QFD published in Japan’s three major QC-related magazines for two decades, 1967 to 1986. At first, the concept of QFD did not arouse public interest. But after the publication of my paper and the presentation by Mitsubishi Heavy Industries in 1972, the number of papers increased and the publication of the first book on QFD in 1978 prompted rapid implementation of QFD. Recently, the three magazines each year carry 50 to 60 reports on case examples of QFD application to development of new products and other business operations.

In 1975 a quality function deployment study group was organized in the Japanese Society for Quality Control and it continued to make studies for ten years. The survey mentioned was conducted at the end of the ten-year study period. In 1987 the Japanese Standards Association published a book on QFD that consisted mainly of case examples, and its translations were published in the United States and Germany. In 1990 an introductory book and books for exercises were published by JUSE and these books are being used by many companies today.

The first seminar on QFD (two days) was spon-

sored by the Japan Productive Science Association in 1983. This was followed by a three-day seminar organized by the Japanese Standards Association, a two-day seminar sponsored the Central Japan Quality Control Association, and a four-day seminar held by JUSE. All of this shows that great efforts have been made by various organizations to disseminate QFD.

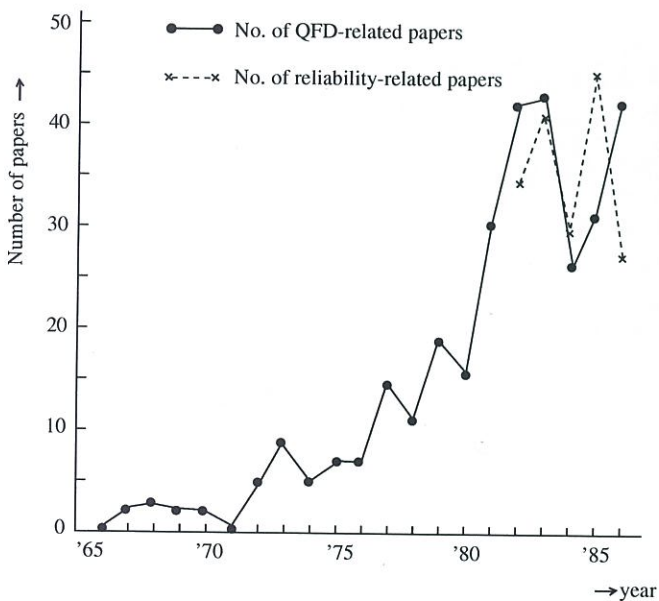


Figure 1 Year-to-Year Changes in the Number of QFD-Related Papers Published

A QFD study group formed by JUSE has functioned since 1988. Every year it holds five regular meetings at which the participants attend lectures and report case examples in the morning and join in discussions during afternoon sessions.

At the first year's meetings, sessions were classified by industry, but in the second year they were grouped according to themes common to all forms of industry:

- (1) Study in methods for identifying required quality
- (2) Study in quality deployment methods
- (3) Quality deployment based on seeds of product development
- (4) Comprehensive quality deployment
- (5) Computer-aided quality deployment system

The results of studies conducted at the sessions were presented in an article titled, "Method Series: Quality Function Deployment and its Applications," published in Quality Control magazine in 1990.

Studies were conducted in almost the same manner at subsequent meetings with new themes and points added for consideration. And I shall now present the major results.

The First Symposium on Quality Function Deployment was held in 1991 together with a meeting for reports on the results of research by the study group. At the 1994 Fourth Symposium on Quality Function Deployment, wishes to hold an international symposium on QFD were expressed, and the Fifth Symposium took place in 1995 as the First International Symposium on Quality Function Deployment. A total of 174 persons, including 63 from abroad, attended and the presence of 39 from Korea and 21 from Brazil attracted special attention. Nikkei Mechanical introduced the presentations made by the Korean and Taiwanese participants in its article "Korea and Taiwan Chase Japan in QFD."

The Second International Symposium on Quality Function Deployment took place in Novi, a suburb of Detroit, June 10 and 11, 1996. Some 300 persons from around the world attended and it proved to be a genuinely exciting event. Representatives from 13 countries made presentations. The organizers told me that they received 41 applications but presentations were held to 13 owing to space limitations. Table 1 shows the nationalities of the representatives who made presentations and the areas to which QFD was applied. Prior to 1995 there had been many instances of QFD application to the US automotive industry. The special feature of the 1996 symposium was that QFD had taken root in many firms and spread beyond the automotive industry, although there remained cases of QFD in the manufacture of automotive parts as indicated in the machinery industry column of the table. The symposium organizer also received many applications for presentations from management consultants and universities, which suggests that research in QFD progressed in various countries and that it helped to promote the use of QFD in enterprises spanning numerous fields of endeavor.

Table 1 Countries That Made Presentations at the Second International Symposium on Quality Function Deployment and Areas to Which QFD Was Applied

	United States	Japan	Brazil	Germany	Taiwan	Sweden	Australia	United Kingdom	Finland	Korea	Hong Kong	Israel	Spain	Total
Construction										1	1			2
Machinery	2	1				1								4
Electronics	1			1							1			3
Services	1	1			1									3
Software				1										1
Food	1	2												3
Consumer electronics	2													2
Medical care	1													1
Chemicals, Iron & Steel	2	2												4
Management consultants	5	1					1					1		8
Universities	2	2		1	1									7
Research institutes				1										2
Total	17	4	5	3	2	2	1	1	1	1	1	1	1	241

Management consultant and university representatives made presentations on the concept of and methods for QFD. Particularly, in terms of QFD methods, many presentations on new efforts, such as conjoint analysis, TRIZ, conflict management, and combinations with the Taguchi method, were made at the symposium. With respect to the QFD concept, reports were given on approaches to the strategic aspect of QFD.

Four Japanese participants made presentations, and each attracted quite a bit of attention. Prof. Kozo Koura of Asahi University presented the results of his research down through the years while in JUSE's QFD study group. His talk, "How to Link Materials and Technological Seeds to Customer Demands," drew great interest as it was seldom discussed other than in Japan.

Mr. Susumu Yamamoto of Kawasaki Heavy Industries Co., Ltd., presented case examples of in-house QFD training and promotion under the title "QFD at Kawasaki Heavy Industries." Because of the practicality of his basic quality charts for each product and simple quality charts for model changes, his talk aroused so much interest that, following his presentation, there seemed to be no end to questions from the audience.

Mr. Kenji Kaneko of the Service Management Research Institute spoke on the theme "QFD in Hospital Cleaning Service." Cleaning work is viewed as difficult to deploy and standardize on the basis of quality charts, but his presentation was highly rated for the fact that he promoted the technological deployment and standardization of cleaning work and obtained an ISO9000 certification for the first time in the industry.

Prof. Shohei Ishizu of Aoyama Gakuin University, who was studying in America at the time, attended the symposium. He had succeeded the late Prof. Yasushi Furukawa of Hiroshima University in the study of systems and spoke on the "Role of QFD in Quality Information Systems," wherein he sorted out and put together existing quality information systems from the aspect of system study. In his report he presented a method for developing QFD in the future.

On the first day of the symposium a gala dinner party was held and at it the Akao Prize, which was established by the American QFD Institute for the symposium in 1996, was presented to two Americans and one Japanese for their years of valuable contribution to the development and dissemination of QFD. The awardees were Mr. Bob King of GOAL/QCP Corp.; Mr. Larry Sullivan, former chairman of the American Supplier Institute; and Prof. Tadashi Yoshizawa of Tsukuba University, who was vice chairman of the

steering committee for JUSE's QFD study group.

The third day of the symposium featured a QFD forum held under the sponsorship of the American QFD Institute. Lively discussions were conducted by specialists from the institute.

The symposium was highly animated throughout, showing that Americans were more interested in QFD than the Japanese. In addition, many books on QFD were being published in the United States, and it was reported in the American Society for Quality Control's organ Quality Control that there were more than 30 software products on sale that incorporated the concept of QFD. Such facts brought me to realize that Japan's competitive edge in QFD was endangered and that in the future Japan needed to develop QFD even more.

In the following paragraphs I shall discuss the process in which QFD developed other than in Japan.

Introduction of QFD to the Occident started with the contribution of my paper to the American Society for Quality Control's organ Quality Control and the four-day seminar which I held in Chicago under the theme "Company-wide Quality Control and Quality Deployment." After 1986 I lectured on QFD every year at GOAL/QPC, for which Mr. B. King worked, ASI and other organizations. Meanwhile, Mr. Akira Fukuhara, a management consultant, worked to spread QFD mainly in ASI. The status of QFD in the United States in subsequent years was elaborated in the presentation that Mr. G. H. Mazur made at the Fourth Symposium on Quality Function Deployment in 1994.

I gave introductory lectures on QFD at Garugano, Inc., in Italy, every year after 1987. In Europe QFD was implemented from the earliest days of development, and the First European Symposium on Quality Function Deployment was held in 1993. In Korea I lectured on QFD at the Korean Standards Association every year from 1978 to 1985, but it did not come into practical use. Recently, though, Koreans have taken an interest in QFD and they formed a QFD study group in January 1994. I also gave introductory lectures on QFD in Taiwan from 1982 to 1986, but it has seen practical use only recently. At present the Chinese Production Center is working hard to diffuse QFD.

In Brazil I introduced QFD at ICQC-1989 held in Rio de Janeiro during that year. Later, Mr. Tadashi Daito worked to disseminate QFD. The development of new products has been stressed in China recently and I held seminars in Beijing during June 1994 and in Shanghai during September of the next year at the request of the State Technological Supervision Agency.

In 1994 the First Pacific Rim Symposium on Quality Deployment met in Australia. The status of implementing of QFD in various countries in subsequent years is shown in Table 1.

Future Issues of QFD

The concept of concurrent engineering recently has been introduced to Japan from the United States in real earnest. It is said, however, that concurrent engineering was originally an empirical management method that Japanese automotive manufacturers used and was transferred to the US. It is also said that in America the operations of planning, development, preparation for production, and production were traditionally conducted separately, while in Japan they were undertaken concurrently and harmoniously, thus making development of new products successful. Concurrent engineering aims to build a management method for developing new products through the use of information technology and computer systems. And the Taguchi method and QFD, both developed in Japan, are regarded as a major method for concurrent engineering and are attracting the attention of Americans.

In Figure 2, as prepared by Mr. L. Sullivan, the axis of abscissa represents the number of months traced back from the start of design work, while the axis of the ordinate represents the number of design changes made; and the numbers of design changes made in the process of developing new products in both Japan and the United States are compared.

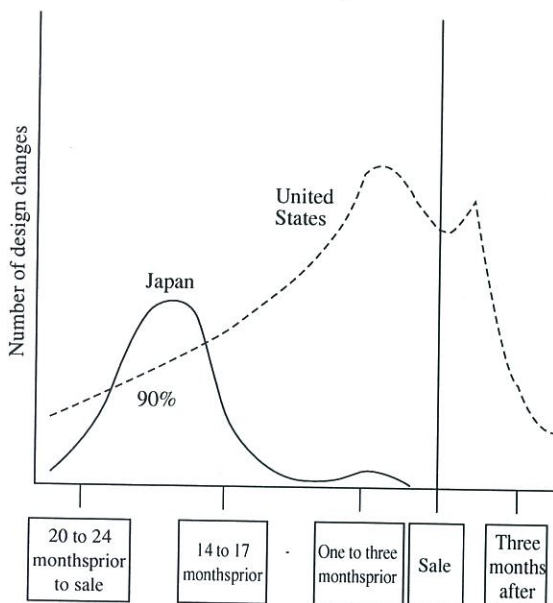


Figure 2 Comparison of the Numbers of Design Changes Made in Japan and the United States (prepared by Mr. Larry Sullivan)

With automobiles, marketing is completed approximately two years prior to sales, after which design work begins. In America, as design progresses, the number of design changes increases, reaching its peak one to three months prior to the start of sales, and countermeasures are taken for design changes. New products are marketed because the number of design changes has decreased pursuant to the countermeasures. This results in complaints, which prompts further design changes. By contrast, in Japan 90 percent of the design changes are made at the early stage of design work and only minor changes occur one to three months prior to sales because changes are controlled upstream in the design process to ensure that problems will not flow downstream.

It was once said that new product development is the responsibility of marketing (market research), but in the case of automobiles it takes as many as two years from the start of design to launch a product. The superiority of Japanese products over those of other countries can be attributed to successful quality control in this process. Only marketing was formerly stressed in the development of new products, but marketing refers to the area located to the left of the curved lines in Figure 2, namely, operations preceding the start of design. Management of new-product development should cover all processes, from planning and design to preparation for production, manufacture and inspection, to marketing and sales. QFD constitutes an upstream management method for precluding problems and starting production smoothly at all processes.

Traditionally, engineering focused only on technology for finished products and the management of mass production. It is considered that the absence of engineering that covered all processes from the start of production to launching new products was a blind spot. Concurrent engineering also represents a form of concurrent development and is not a generic name. We should recognize that, viewed from the management angle, it represents merely one form of engineering. Thus, at the QFD Symposium held in 1994 I referred to it by the more general name of development management and stressed that QFD and concurrent engineering should evolve as part of development management. At the First International Symposium Quality Function Deployment, held in 1995, I spoke under the theme "QFD Toward Building Development Management Systems."

An important future task will be to develop this method and build a system for launching new products more efficiently and smoothly in shorter periods

of time at lower cost so that more rewarding results can be enjoyed.

In the preceding section I explained that progress in the application of QFD and its research is being made in countries other than Japan. Such trends are revealed by a survey of the status of OFD implementation as conducted jointly by Tamagawa and Michigan universities. I shall present part of the results of the survey in the following paragraphs.

In this joint survey, questionnaires of the same type were sent to 400 Japanese companies then participating in JUSE's QFD study group and introductory lecture courses on QFD, and to 400 similar American firms. Of the Japanese pollees, 146 (37.5%) responded and in the US, 147 (37.6%) did.

In Japan 31.5 percent of the respondents stated that they used QFD in their product development process, while the US percentage for this was 68.5. Table 2 shows major industries that used QFD. Many firms in the automotive and electronics industries used QFD, as shown in other surveys, but widespread use of QFD in the American aerospace industry merits attention.

Table 3 indicates that American enterprises displayed a higher rate of increase in using QFD than Japanese counterparts. Many mentioned "for better design" and "to enhance customer satisfaction" as their purpose for using QFD, but US companies placed more emphasis on the latter. Also, more American firms cited "a tool for communication and coordination among job functions" and "to reduce product cycle time." Table 4 shows replies to the question of how various new products differed from existing ones. Noteworthy is the fact that in Japan many new products were developed by improving existing ones, while in America QFD was applied in developing "totally new" or "next-generation" products.

Table2 Major Industries Represented by Enterprises That Responded

Major industries	Japan	United States
Automotive	28.6	21.4
Electronics	9.5	13.2
Chemicals	9.5	7.1
Construction	7.1	4.0
Medical care and health	4.8	7.1
Services	4.8	7.2
Software	3.1	3.1
Computer	2.4	1.0
Consumer electronics	2.4	0.0
Aerospace	2.4	10.2
Food	0.0	2.0
Government agencies	0.0	1.0
Others	26.2	22.5

Table3 Reasons for Using QFD

Reasons for using QFD	Japan	United States
For better design	89.1	84.0
To enhance customer satisfaction	65.2	89.0
Instruction from top management	50.0	44.4
Tool for communication among job functions	41.3	75.5
Learned of it from books and magazines and thought that it would be effective	34.8	0.0
Recommended by management consultants or specialist organizations	34.8	43.9
To reduce product cycle time	30.4	68.0
Because competitors use it	8.7	21.7
Request from customers	6.5	11.9

Table4 The Difference of New Products from Existing Ones

How different from existing products?	Japan	United States
Completely different products (up to 100%)	2.2	24.5
Next-generation products (up to 75%)	17.8	29.6
Considerably different (up to 50%)	31.1	26.5
Different to a certain extent (up to 25%)	48.9	19.4

Table 5 draws attention to the fact that many companies formed dedicated QFD teams consisting of many job functions and that more than 80 percent of decisions were made at QFD team meetings. In both Japan and America QFD teams consisted of ten persons or fewer and the time spent for each meeting was no more than two hours. American firms surpassed those of Japan in having QFD teams who met more than once a week.

In the United States, as Table 6 indicates, the sources of information for preparation of quality charts were "personal interviews with customers," "customer surveys conducted for QFD" and "interviews with focus groups composed of customers." Many Japanese firms obtained information from the "expertise of product design teams" and "customer complaints." Such negative sources of quality information will make Japanese companies lag behind in creating appealing products. Table 7 shows that in America support, such as "sufficient budget for implementation of QFD," "adequate resources" and "enough time to effect QFD," was given in the application of QFD, which suggests that importance was placed on QFD in corporate operations.

As treated above, it is hoped that QFD will further evolve as an important method for building development management systems. And it is also hoped that it will be further enhanced as a means for creating more attractive quality and will provide a better way

to develop more innovative products. But further advancement of QFD through research in corporate management methods to heighten its effectiveness and the combining of QFD with marketing and other methods are sought as well.

Table5 Overview of QFD Teams

Forms/meetings of QFD teams	Japan	United States
Dedicated teams consisting of many job functions (Q.4)	32.6	82.8
Teams consisting of a single job function (Q.4)	32.6	
Teams comprising ten members or less (Q.10)	91.3	75.0
Teams that meet more than once a week (Q.6)	35.1	51.1
Teams that meet once every two weeks (Q.6)	29.7	
Meetings that lasted less than two hours (Q.7)	59.5	58.7
More than 80% of decisions made at QFD meetings (Q.8)	28.6	59.6
More than 50% of decisions made at QFD meetings (Q.8)	57.1	

Table6 Sources of Information for Preparation of Quality Charts

Sources of information	Japan	United States
Product design team expertise	64.4	59.6
Customer complaints	64.4	35.0
Visits to and observations of customers	57.8	65.7
Benchmarks for competitive products	48.9	52.5
Brainstorming	48.9	0.0
Managers' experience with products and the market	44.4	28.0
Existing marketing data	37.8	44.4
Personal interviews with customers	35.6	65.7
This customer survey conducted with respect to QFD	35.6	64.0
Information from dealers	33.3	15.1
Product clinics (product review by customers)	33.3	0.0
Product guarantee data	31.1	18.1
Past QFD activities	22.2	10.2
Observations of customers at various trade shows and fairs	22.2	14.4
Interviews with focus groups of customers	13.3	46.5

Table7 Support as Given to Implementing QFD

Support to implementing QFD	Japan	United States
Understanding and support from QFD team members	58.7	21.2
Understanding and support from top management	39.1	33.7
Sufficient time for gathering information on customer requirements	37.0	36.0
Sufficient budget for implementation of QFD	15.0	53.7
Adequate resources	10.9	42.3
Enough time to effect QFD	3.0	39.0

Conclusion

I started this treatise by discussing the role of QFD in TQC and went on to describe the status of implementing QFD in Japan and other countries. QFD was invented in Japan and developed through its application by various enterprises. However, other countries recently have introduced it as a novel management technique and they seem to have taken a step forward in its computerization. I hope that the readers of this series will review QFD in search of how to make it more helpful to corporate management. As the comparative study of Japan and the United States shows, more and more American enterprises are effecting QFD on a company-wide scale and research in ways to conduct QFD is under way. Leaving QFD only to the personnel responsible, as Japanese companies are wont to do, will make us lag behind soon or later. I hope that Japanese firms will make good use of this series to further develop QFD, thus maintaining Japan's competitive edge in the world market.