# East Meets West: A Critical Analysis on The Evolution, Growth and Transfer of QFD from Japan to The West

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## Abstract

This paper describes the origins, evolution of Quality Function Deployment and its transfer to the West. Following a comprehensive review of the literature and how QFD has been defined, and applied, the paper analyses the critical factors which impinge on QFD implementation success.

A discussion which covers the enabling criteria found to be inherent in Japanese applications is contrasted with the Western approaches documented hitherto. In particular the Company Wide Quality Control (CWQC) approach in Japan versus the emerging concept of Total Quality Management and their impact on QFD implementation.

A critical analysis of the main differences isolated from the review of the literature and which characterise the Japanese method of QFD implementation which is leading, and The Western approaches which appear to be lagging is included in the paper, together with some useful conclusions:

**Key Words :** Quality Function Deployment, Quality Tools, Company Wide Quality Control, Quality Charts, Customer Satisfaction.

## 1. The Philosophy, Components and Developments that have led to Current QFD Use

It is appropriate to understand the basic philosophy that led to the development of QFD

and the key components that make up the House of Quality that is typically associated with former. A critical part of this is to consider the development of QFD, initially in Japan, and later how it was translated and applied in USA, Europe and the 'Western' world in general. This discussion on the developments will highlight both the cultural difference on interpretation and application. It will also identify why QFD usage today is still in a state of development within the West in particular.

First, however, it is essential to identify from a broad base of the existing literature from the East and West, what some of the formal definitions of QFD are, and what the fundamental agreements or disagreements within the worldwide QFD as a whole do exist.

## 2. Some Working Definitions and Descriptions of Quality Function Deployment

In the Ford *'Quality Function Deployment - Executive Briefing'* (1987), it was stated that there was no single definition for Quality Function deployment. It was however proposed that as a starting point, the following definition could be adopted: *"A system for translating customer requirements into appropriate company requirements at each stage (of the product development cycle) from research and product development to engineering and manufacturing to marketing/sales and distribution"*. Despite there being revisions to this definition within Ford Motor Company Limited, the essence of the definition remains the same, although more recent QFD definitions within Ford Motor Company have added breadth by including key words such as, quality , value, target setting process, planning tool, customer driven product development process, customer focused engineering and customer satisfaction. A selection of excepts over time include;

Kathawala & Motwani [1994) simply state *'QFD can reduce the risk of misinterpreting customer requirements'*. Kathawala & Motwani [1994] further quote from the work of Maddux, Amos & Wyskis (1991), that *'QFD's objectives are to: identify the customer, determine what the customer wants, and provide a way to meet the customer's desires'*. Asaka and Ozeki [1988] place great emphasis on the word 'planning' in their descriptions of QFD as do Sullivan [1988], McElroy [1989]. Asaka and Ozeki [1988], however' prefer to shorten the term 'quality function deployment' to just *'quality deployment'*, and state that quality deployment (or QFD) *'defines the functions of planning, development, design and manufacturing of a product to satisfy the quality requirements of customers'*. This shortening

of QFD to just quality deployment is consistent with Akao [1988]. Quality deployment refers to the charts, tables and descriptive matrices used to design in the quality (or *'goodness'*) required by the customer in the product . He has two definitions for QFD, one narrow, and one broad;

i) narrow QFD definition: *'The business or task functions responsible for quality (design, manufacturing, production).'*

ii) broad QFD definition: *'A combination of these business or task functions responsible for quality (design, manufacturing, production etc.) and the quality deployment charts.'*

Akao adds that *'function deployment is often a later step in QFD where the basic functions of the product or service are identified by experienced people at the production company.'* He likens function deployment to the *'voice of the engineer'* who has the task of identifying the *'must be'* attributes of the product, where He gives the example of 'must be' as an unspoken customer requirement, an attribute that must be there, otherwise it is a source of dissatisfaction to the customer (such as a bed, and bathroom in a hotel, that the customer must have). He asserts that to have these 'must be' attributes, or functions, does not guarantee customer satisfaction, it only ensures no strong dissatisfaction. He summarises this argument by stating that when customer's spoken quality demand opposes these 'must be' attributes or functions, then the producer of the product or service must balance the spoken demands with practical functional requirements of the product or service in the purpose of the quality charts or quality tables as a *'means to..'* not *'an end in themselves'*, that is to say they are there to provide insight into the nature of the product or service and what is necessary to improve it with relation to the spoken quality demands of the customer.

Asaka and Ozeki [1988] further develop what they mean by quality requirements of the customer by stating the product or service must meet or fulfil customer standards, needs, expectations and future unanticipated needs and aspirations, 100% of the time. This total product development cycle definition of QFD driven by an extreme level of customer expectation by Asaka and Ozeki [1988] proposes a very stringent test for QFD success.

Slinger [1992] neatly proposes that *'Quality Function Deployment is a design tool which is a powerful support to 'encouraging' engineering design teams to take a structured,*

*thorough approach to product design'*. Slinger [1992] and Metherell [1991] further describe a four stage (phase) QFD process as part of an integrated engineering process, which they illustrate as linked into Simultaneous Engineering using teamwork, training and planning. (See Fig 1). Metherell [1991] adds to the setting of QFD and Simultaneous Engineering in context with Integrated Engineering by emphasising the focus for team effort. (See Fig. 2). Metherell [1991] also intimates that QFD as part of this Integrated Engineering process, is consistent with the highest 'opportunity for change' at the concept levels (see Fig. 3), and offers traceability throughout the product cycle.

Consistent with the previous two authors, Hauser and Clausing [1988] propose a definition of QFD through reference to its classic House of Quality matrix that reads 'the house of quality is a kind of conceptual map that provides the means for inter-functional planning and communications'. They further suggest that people with different problems and responsibilities can thrash out design priorities by referring to patterns of evidence from the house of quality. This interpretation adds to argument for QFD being more than just a planning tool scenario, but also as a tool for interdisciplinary communications within any company. Hauser and Clausing's [1988] definition proposes that QFD is both a planning and communications tool that helps focus and coordinate skills within an organisation from design to manufacture into a product customers want and will continue to buy. This definition is concurred by McElroy (1989) who refers to QFD as a 'powerful planning tool', and quotes Dana Cound (a VP within GenCorp Automotive) as saying it is 'a typical Japanese take-nothing for granted procedure that makes you write everything down' (as opposed to the traditional approach that leaves too much to chance).

## 3. QFD and its Link to Policy Deployment

Sullivan [1988] corroborates this view that QFD is both a planning tool and aid to communication and observes that several U.S. companies (notably Ford) show case studies being very successful in applying the QFD matrix charts which in turn has helped integrate the various diverse activities within that company. Sullivan develops this argument, however, by suggesting that QFD can be used as the 'hardware' through which 'policy management' which he refers to as the, 'software' can be integrated. The difference with policy management to 'objective management', the more typical style of management, is that the latter is based on measuring performance by results, while the former focuses on developing the means of achieving results through methods, systems, or resources. The foundation of policy management Sullivan suggests is 'business planning'. Business planning in turn is

based on employee ownership or entrepreneurship to set goals through a comprehensive planning process across the whole organisation, by reducing the void between departments. The results from this level of detail then becomes the results of the policy means and a measure of policy management success. In summary Sullivan proposes that 'soft technologies' such as policy management are important to achieve the business plan, and that this must be integrated through congruent objectives with the use of 'hard technologies' such as QFD, Taguchi Methods, SPC, to deploy product requirements. All these elements combined deliver the key goal of meeting customer expectations.

This argument for QFD being an integral part of business planning is corroborated by Barlow [1995], who refers to 'policy deployment' in the same context. Greenall [1995] on the other hand, describes policy deployment as process focused, rather then management by objectives, which is reiterated by Barlow [1995] who uses Kawneer UK Ltd as an example of policy deployment in action. Barlow's description of policy deployment mirrors the key elements of a QFD in that both ensure a clear understanding of the company objectives, goals and direction, both are diagnostic tools that set targets through focusing on the *'vital few objectives'*, both place emphasis on team building and good communications, and both focus on the interaction of all tools (including QFD) to achieve an integrated business plan.

The idea of using QFD within an organisation as an aid to business planning becomes clear when placed in the context of its numerous and varied benefits. Zairi [1993] summaries four key benefits as being; higher quality, lower cost, shorter timing and marketing advantage. Akao's [1988] survey of QFD benefits within Japanese industry quotes five key process benefits of; decreased start-up problems, competitive analysis became possible, control points clarified, effective communications between divisions, design intent carried through to manufacturing. Hideaki Aoki, Yukio Kawasaki and Takao Taniguchi [1990] on the other hand, relate the benefits of QFD as being in conjunction with *'quality charts, related procedures of new product development and quality assurance activities'* and summarises these into two broad benefits that lead to;

i) the development of new products that both meets the customers' demands and wins their trust as well as being developed in a timely manner to lead the market.

ii) the improvement of interdepartmental communication on product development, by identifying problems from early predesign stage to ensure development and process time reductions.

Finally a tidy description of QFD is given by Reynolds, who proposes that the planning process of Quality Function Deployment is the major development in the Quality sector of business. Reynolds describes QFD as a tool that uses 'a sophisticated subjective analysis to design an "optimal" product with maximum customer satisfaction assured.' This definition places emphasises on the subjective approach QFD offers and that optimisation of the product is the route to maximum customer satisfaction.

## 4. The Inception of the Quality Chart

Yoji Akao introduced the initial concept of Quality Function Deployment (QFD) as an approach to design in Japan back in 1966. This was in response to the growing need for critical points of *'quality assurance'* to be carried through design and manufacturing. This need was really a natural progression of Akao's role in developing 'Total Quality' at this time. Through the 1950's and 1960's the principles and techniques of Total Quality was being spread amongst such guru's as W.Edwards Deming, Joseph Juran, Armand Feigenbaum and from Japan, Kaoru Ishikawa, Shigeru Mizuno, Masao Kogure.

Up to the mid 1960's, however, key areas such as identifying *'customer demand'* and its subsequent establishment into design quality had only techniques such as the Ishikawa *'fish bone'* chart to systemize the process. It was Akao who first proposed the need to develop a unique process that linked customer demand with the quality of design and subsequent manufacturing processes that precipitated Quality Function Deployment. In support of this approach Akao refers to Professor Koichi Aiba whom Akao quotes as stating, *'quality design is the entire process of converting the quality demanded by the customer - the true characteristics - into counterpart characteristics, by means of reasoning, translating, and transferring.'*

## 5. The Growth and Development of QFD in Japan

The first developments of quality charting that precipitated QFD was begun by Shigero Mizuno at Mitsubishi Heavy Industries in 1966. By 1969 the concept of 'Function Deployment of Business' was introduced at Matsushita by Katsuyoshi Ishihara [1993], This beginnings of the systemised QFD was instigated by Drs. Mizuno and Furukawa [1988] who created a *'matrix of customer demands and quality characteristics'* for Japan's Mitsubishi

Kobe shipyard. This matrix was inspired by the work of Koichi Nishmura [1972] who further developed and introduced *'quality charts'* in May 1972. It was the first time that the symbols of strong double circle, medium circle and weak triangle were used to indicate strength of relationships, or degree of correlations between what Nishmura [1972] described as *'demanded qualities'* and *'quality elements'.*

Akira Takayanagi [1973] further defined the quality chart as the *'relationship between true or actual quality (as demanded by the customer) systemized according to function, and quality characteristics as counterpart characteristics.* Akao [1988] on the other hand summarises the concept of the quality chart as a *'basic chart for quality design'.* Akao further proposes that the quality chart is a graphic device that enables us to;

*i. analyse systematically the structure of the true or ultimate qualities demanded by customers in their own words,*

*ii. to indicate the relationship between these demanded qualities and certain quality characteristics,*

*iii. to convert customer demands into counterpart characteristics,*

*iv. to implement design quality.*

It was the work by Yoji Akao at Tanmagwa University in Tokyo in 1972 that expanded the quality chart system into Quality Function Deployment (QFD) [1991]. It was this development of quality charting into the format we know of as QFD that saw its first practical use within industry at the Kobe shipbuilding yards in southern Japan by Mitsubishi Heavy Industries, Limited. By 1975 the computer research committee of the Japan Society for Quality Control gave momentum to QFD by setting up a study on Deployment of the Quality Function. The Japanese automotive industry saw its first rigorous use of QFD at Toyota Autobody in 1977.

Toyota Autobody developed four vans between 1977 and 1984, and with the aid of QFD reported a progressive reduction in start up costs in launching each new van, culminating with the fourth launch cost reduction in 1984 of 61% compared to their 1977 benchmark launch [1988].

The greater use of QFD within Japan was largely a result of Drs. Akao and Mizuno co-editing an article on the subject in 1978, again called 'Deployment of the Quality Function'. By the early 1980's various cost deployment tools, including value engineering, were integrated with QFD by Dr. Akao with the Futaba Corporation being amongst the first to benefit Methodologies such *'bottleneck engineering'* a critical breakthrough technique developed by Dr. Furukawa coupled with reliability engineering and new technologies were also blended with QFD by Dr. Akao. In 1980, Kayaba won the Deming Prize using QFD with Furukawa's 'bottleneck engineering'. It can be said, therefore that QFD effectively came of age in terms of its industrially demonstrated benefits and its academic recognition within Japan during the early 1980's. It is this period that also saw the first widespread awareness of QFD within USA and Europe, which is where attention on the development of QFD will now be focused. Figure 3 for an example shows typically Japanese and US companies typically apply their engineering changes. Figure 4 for an example of how Japanese and US companies compare with regard to quality effort during the product development cycle.

## 6. The Transfer of QFD from Japan to the U.S. and Europe:

In October 1983 Akao introduced QFD to the United States of America in the Quality Progress, the journal of the American Society of Quality Control (ASQC) [1988]. This was the first time the letters QFD appeared in print in the U.S. and Japanese case studies being discussed were already 10 years old. Also in 1983 the Cambridge Corporation of Tokyo led by Masaaki Imai introduced QFD in Chicago with Akao, Furukawa and Kogure presenting. Dr Clausing of Fuji Xerox introduced QFD to Ford Motor Company in 1984, whilst GOAL/QPC began offering training courses to U.S. companies. Furthermore, in 1984 Ford had created the American Suppliers Institute (from ex Ford management to support the training and dissemination of QFD within the Company. By 1985 Ford Body and Assembly in the U.S. began to develop QFD projects with its suppliers which included missions to Japan with supporting involvement from Toyota Auto Body which further formalised the process of QFD within the U.S.

Bob King of GOAL/QPC also translated the training material of Akao into English with a completely American frame of reference and with help from Lawrence Shillito of Eastman Kodak Company, who included the integration of Value Analysis into QFD. In 1986 both GOAL/QPC and ASI began offering extensive QFD training to the automobile industry suppliers and other companies such as Budd Company and Kelsey-Hayes (the first

non-Japanese case study). Ford and General Motors began their own QFD training in 1987. In 1988 J.Hauser and D.Clausing published *'The House of Quality'* in the *'Harvard Business Review'* while *'Quality Progress'* published various articles on QFD and its relationship to other quality tools such as policy management, Taguchi methods and SPC. By 1988, the first U.S. automotive vehicle gained benefits from QFD input in the form of the Lincoln Continental. Ford, General Motors, Digital Equipment, Hewlett-Packard, AT&T and ITT all began using QFD, with Ford alone deploying more than 50 applications of QFD throughout 1988. In 1989 ASI organised their First Symposium on QFD in Detroit, Michigan, USA, which has become an annual event since. In 1992 ASI of Britain organised their First European Conference on QFD which has also become an annual event there too.

## 7. Eastern versus Western QFD Implementation Styles

One of the first key differences between the East and West, as described by Kano [1993] in the nomenclature which the Japanese call it 'Quality Deployment', while the West (USA and Europe) call 'Quality *Function* Deployment'. Although this may just seem to be semantics, it holds a deeper more fundamental difference, which Kano [1993] and other authors describe as a cultural difference in the implementation of QFD. Kano [1993] eludes to this cultural difference by his observation that many Western practitioners of QFD tend to apply QFD to demonstrate its use and claim, as part of the commitment to quality improvement, rather as he implies, to implement it fully throughout the product development process to solve problems. This approach suggested by Kano [1993] points to the use of QFD in the West as a front end product development tool emphasising the element of design 'function'. The Japanese, however, have historically applied QFD throughout the product development, including production, emphasising the element of 'deployment'. Akao [1988] supports these fundamental differences of definition and implementation between the Japanese and the Western style of QFD (as practised in North America and Europe). The Akao's [1988] definition of QFD places an emphasis on the *'combination'* of identifying business and task *'function'* responsible for quality and the use of *'quality deployment'* charts to effect the process downstream into the product. In North America and Europe, however, Akao [1988] suggests that it is just the *'quality deployment'* chart process (effectively the quality chart tool itself ) that is referred to as *'quality function deployment'*. Akao [1988] emphasises the holistic approach to QFD within Japan by asserting a comprehensive quality function deployment system must reflect technology, reliability and cost considerations.

Bob King [1988], Fortuna [1988] and Hauser and Clausing [1988] note that most companies in the U.S. have focused on the *'single matrix'* (most commonly known as the *'house of quality'* due to its shape as developed in Japan in 1977). According to King, U.S. companies have spurned the potential of integrating QFD with cost deployment tools, bottleneck engineering or new technology development. Although companies such as Ford and General Electric in the U.S. have utilised QFD to provide a transition from design to manufacturing, Bob King makes the point that generally U.S. companies have not realised the full potential of QFD. King emphasises this point by suggesting that for future progress of QFD within the U.S., companies need to follow the example of their Japanese counterparts who have been far more creative with their customisation of QFD and its integration with various aspects of company management within a comprehensive variety of industries and services.

Hauser and Clausing [1988] as well as Fortuna [1988] support this argument. An illustration of the flexibility within Japan that QFD has been used includes consumer electronics, integrated circuits, domestic appliances, clothing, synthetic rubber, construction equipment, agricultural engines, swimming school services, retail outlets, apartment design as the better known automobile manufacturing and ship building industry examples. Fortuna [1988] adds that customisation is both practical and desirable as it adds to its acceptance and usability with existing technology and engineering formats within a company. Fortuna also adds that the Japanese approach to QFD emphasises the downstream benefits by progressing QFD into Phases three and four, while U.S. companies tend to just focus on the first house of quality phase claiming it to have the most significant effect. The Japanese use of QFD includes the resolution of conflicting design requirements which prompts integrating various quality tools including Taguchi methods (that the Japanese attribute 50% of total quality improvement), experimental design, fault tree analysis, failure mode and effects analysis (FMEA) and the seven management planning tools.

Zairi [1993], Sullivan [1986] Asaka and Ozeki [1988] all describe the Japanese approach to QFD as part of Company-wide Quality Control (CWQC), which was not described in the U.S. Quality Progress journal until May 1986 but was first initiated in Japan in 1968 shortly after the first seeds of QFD were sown through quality charting in 1966. Sullivan describes three key characteristics of CWQC as;

i).philosophy,

ii).specification and

iii).customer desires deployment mechanism.

This third mechanism deploys the customer desires both vertically and horizontally throughout the company. Sullivan [1986] states that quality function deployment serves as the *'operational definition'* for CWQC. He further describes QFD as the mechanism that Japanese companies use to *'bring new (and carryover) products to markets sooner than the competition with lower costs and improved quality'*. Zairi [1993] simplifies the description of the CWQC process description by quoting the Japanese Industrial Standard Z8101-1981 for quality control as *'a system of means to economically produce goods and services which satisfies customer's requirements'*. In this way, Zairi [1993] further suggests that in the Japanese context of this is about a culture of prevention and not simply carrying out corrections as is traditionally done. Also the CWQC can be viewed as having two axis of explanation,

i) vertically as a philosophy of continuous improvement through encouraging involvement, goal setting, training and communications and

ii) a horizontally through the use of QFD through encouraging multi functional team building to focus on technological development and prioritisation.

Zairi [1993], stresses that the ultimate use of QFD as an integral part of the TQM philosophy. Fortuna [3] agrees with these arguments and adds that companies who move from manufacturing process quality control to product development quality control by embracing QFD may well be distinguished as the worldwide market leaders.

In the context of CWQC and TQM, Asaka and Ozeki [1988] simply give CWQC another name, *'Total Quality Control'* (TQC) and supports an argument by Zairi [1993], that CWQC (or TQC) is part of the Total Quality Management (TQM) philosophy. Zairi and Oakland [1995] make a comparison of TQM use not between East and West but within the West.

Overall it is clear that there is a clear divide between CWQC which appears a predominately Eastern philosophy, while TQM which adopts much of the CWQC principles is used both in the East and West although the spread into the west has not progressed much beyond the United States. QFD, on the other hand has spread fully to the West from

the East. However it has been, and will be argued that the full implementation of QFD is still hampered by the restraints Western culture place upon it. If , as argued by Mallon and Mulligan, CWQC is a pre-requisite for successful implementation of QFD, then further discussion of the differences CWQC place between the East and West is necessary.

## 8. TQM and CWQC and their respective impact on QFD implementation

Asaka and Ozeki [1988) suggests that successful implementation of CWQC requires the participation of everyone in the company from the CEO to the hourly worker to promote quality in both 'things' and 'work'. Asaka and Ozeki [1988] add that the *'amazing quality levels in many Japanese Plants (in parts per million) do not come from running fully automated equipment. They come from each person in the workplace knowing and applying quality improvement methods, every day.'* The emphasis Asaka and Ozeki place on CWQC, or TQC, is put into context with QFD by suggesting a key element to TQC is management and staff involvement with planning and QFD. This argument is also supported by Rubinstein [1991] who adds that it is this combination of labour-management partnership process in corporate strategic planning that makes CWQC so successful. Taking this concept further Asaka and Ozeki [1988] also place emphasis in the Japanese company culture for a lifetime commitment by the company and individual for both on the job training and off the job training to support quality goals and objectives, facilitated by job rotation and an atmosphere favourable to education, is not a universally accepted practice in the USA according to Asaka and Ozeki this complete involvement and high sense of quality in the product and workplace, according to them helps to illustrate how the TQC culture in supporting QFD would support a complete product development cycle deployment of QFD and meet the extremes of customer expectation that the Japanese assume the customer to have. This approach to QFD by the Japanese makes a stark contrast to the way QFD is applied in the West when compared to examples already mentioned, and to be discussed.

Another key aspect of the Japanese approach to QFD appears to be thoroughness, according to Ealey [1987]. He quotes Akashi Fukuhara (assistant director of the Central Japan Quality Control Association, and leading authority on QFD) as saying of QFD, *'it came to be an approach that you would use in a company to make sure nothing fell through the cracks in the development process'.* This attitude towards QFD in Japan as a *'take nothing for granted'* process is reiterated by McElroy [1989]. Ealey further quotes

Fukuhara as stating that one real benefit of QFD is the understanding it gives to new Japanese engineers of their next internal customers downstream in the product development process.

To embrace QFD fully it would appear a key cultural shift is required as Sullivan [1986] points out by illustrating the key difference between U.S. and Japanese companies. In Japanese company's the *'customer's voice'* drives all activities, while in the U.S. the *'executive's voice or engineer's voice'* drives the company. The result of this is that the Japanese companies concentrate on what customer's like, while the US companies tend to concentrate efforts on fixing what the customer dislikes. Sullivan [1986] states that the emphasis on the customer's voice requires a change from manufacturing process quality control to product development quality control. Sullivan uses a chart to illustrate the Japanese/U.S. engineering change comparison which illustrates how the Japanese company has invested most of its resources early in the product cycle to make engineering changes, while the U.S. company invests most of its resources and engineering changes just prior to release of its product, thus incurring more changes and more cost through more resources required to get the product right even after the product has been released.

To draw conclusions on the reasons behind this East versus West difference in quality culture, it is necessary to return to the reference of Rubinstein [1991] who describes how the Japanese after World War II developed CWQC. Rubinstein states that the Japanese CWQC culture was in fact a unique amalgam of three components using both eastern and western practices. The first was the science of quality control from the United States, the second was the enlightened management principles from the United States and Europe and the third component was the philosophy of Japan. It is perhaps this third 'Japanese philosophy' component that makes the final quality culture of the East so different and revolutionary to the West. It is also reflected down to the Japanese implementation of QFD, which as already described is an integral part of a CWQC process. Two Western (US) authors, Mallon and Mulligan also strongly reinforce the argument supporting the integration of QFD with CWQC.

In fact Mallon and Mulligan go as far as to state that a fully developed QFD programme cannot be introduced into an organisation without the pre-requisite of CWQC. To take the arguments of Rubinstein and Mallon and Mulligan (1991) as a step further, both Yavas and Baggs [1995] discuss the concept of *'convergent'* versus *'divergent'* cultural thinking between

Western and Eastern cultures. Both authors agree that cultural difference have created different paths of thinking, and this has led to different approaches to the application of QFD, which reflects the Eastern use of QFD within and throughout a CWQC process, while the West typically use QFD as an isolated planning tool at the front of a product design process only. Baggs [150] describes the differences with three words that separate the two cultures, with the Eastern culture being a combination of adaptive, intuitive and synthesis of thought, while Western culture is a combination of analytical, convergent and logical thought processes. In the words of both Varas and Baggs [1995], Eastern culture is *'divergent'* and Western culture is *'convergent'*. From the results of a survey involving some 100 respondents from Western and Eastern companies Varas concludes however that the Western and Asian managers approach to quality processes are converging, with East and West agreeing on three points;

i) Product quality is essential to growth of sales
ii) Quality is 'free' philosophy instead of cost control trade off approach
iii) Quality attributes hold a strategic importance (previously neglected in West)

Despite this the Yavas [1995] survey still shows 'divergence' in the two cultures, particularly with regard to communications between management and the labour force.

To summarise the divergence between the East versus West QFD usage, Cristiano, Liker and White III conclude there were three basic differences between the application of QFD between the USA and Japan. These are summarised as follows:

i) Most QFD usage in the USA (West) has focused on Phase HOQ only rather then full deployment through all the phases of QFD. This results in only a fraction of the benefits from QFD being realised in the West.

ii) Most QFD usage in the USA (West) has focused on new product development, rather then on current product redesign. With the combined effect placing effort on new product unknowns combined with the inexperience of QFD methodology amongst teams the success rates are low.

iii) Most QFD usage in the USA (West) lacks organisational support, including management commitment and resources required to run a QFD. As a result the effectiveness of the QFD methodology is greatly reduced.

Kano [1993] who has a broad experience of both the Eastern and Western quality activities in general and Japanese and US companies in particular brings a balanced view to the East versus West discussion. Kano states that there many similarities between the development of quality activities in American TQM and Japanese TQC. Although some differences exist, they are not critical, and the quality experiences and knowledge are interchangeable (between Japan and USA). Of the differences, He notes three key areas.

(a) The first is that the use of such the so-called seven new management tools for quality control, including QFD, are sometimes used flamboyantly in the west more as a demonstration then a genuine effort to solve problems.

(b) The second difference is there has been a tendency for US products to show genius, yet experience problems, while conversely in Japan products may display less originality yet rarely develop problems. This difference Kano states is the emphasis that Japan place on systematic approaches, while the US place an emphasis on the genius approach. Both countries need to overcome their weaknesses,

(c) The third difference, is largely subjective, but Kano suggests that US (Western) customers tend to be more sensitive to the cost of products while being more tolerant on quality until the product fails, while Japanese (Eastern) customers Kano intimates display the opposite characteristic.

## 9. A way forward and some useful conclusions:

In summary, all the key cultural differences such as those identified by Cristiano, Liker and White III (1989), Varas [1995], Baggs [1995] and Kano [1993] plus all the more specific QFD, TQM and CWQC differences identified by all the previous authors referred to are illustrated in Table 1. This table assumes that the Japanese (East, Asian) companies are deploying QFD effectively, and the differences are largely where the West are lagging behind. This Table is based on the coherent subjective findings of this East versus West literature search. This research presents this table of 'Criteria Impacting Effective QFD Implementation (between) East & West' as a novel view of QFD practice between two contrasting cultures.

It reviewing Table 1, it is not a coincidence that words such as *'commitment'* and *'companywide'* are used, as the findings of the analysis have repeatedly come across these two words when discussing East versus West differences in QFD and Quality comparisons. It is clear that it is the 'commitment' of Japanese companies to deploy the QFD process through to production 'companywide' that sets the Eastern culture apart from Western culture so markedly. It is perhaps no coincidence therefore that a culture like Japan invented QFD, a proactive positive quality function planning and deployment tool, used typically from early in the planning and design process. Equally it is perhaps no coincidence that the United States invented FMEA (Failure Mode Effects Analysis) a reactive negative quality planning and deployment tool used typically downstream in design and production, Rigby and Barnard (1995).

**Table 1.** Criteria Impacting Effective QFD Deployment: East vs West

| Criteria Impacting Effective QFD Deployment | East | West |
|---|---|---|
| Commitment to Customer Satisfaction Companywide | Yes | Partly |
| Commitment to Quality Companywide | Yes | Partly |
| Commitment to Company Wide Quality Control | Yes | No |
| Commitment to Quality Training Companywide | Yes | No |
| Commitment to Teamwork Companywide | Yes | No |
| QFD Teams members are Fully Trained | Yes | No |
| Full Communication Between Management & Labour | Yes | No |
| Full Management Support for QFD Method & Resources | Yes | No |
| Commitment to Resources for Quality Planning (QFD) | Yes | No |
| QFD is Integrated/Transparent in CWQC Process | Yes | No |
| Commitment to Deploy QFD through to Production | Yes | No |
| Commitment to Deploy QFD to New & Current Product | Yes | Partly |
| Follow Divergent Cultural Thought Process to Quality | Yes | No |
| Follow Convergent Cultural Thought Process to Quality | No | Yes |
| Strong On 'Genius' Approach | No | Yes |
| Strong on Systematic Approach | Yes | No |
| Customers are more sensitive to cost then quality | No | Yes |
| Customers are more sensitive to quality then cost | Yes | No |
| QFD is treated More as a Philosophy then a Tool | Yes | No |

3 key hypotheses can perhaps be derived from the aforementioned analysis:

i) *The key benefit of the QFD technique in the eyes of the East is its depth, which takes time to develop.*

ii) *The greatest problem of the QFD in the eyes of the West is its depth, which takes time to develop.*

iii) *In the end the greatest percieved strength of QFD in the East, its depth, is also seen as its greatest weakness in the West.*

As a final note therefore on Eastern versus Western styles of QFD application, it is the actual mechanisation of the QFD quality charts themselves that must be considered/ Akao [1988] raises the observation that most Japanese practices have been to produce the QFD charts on paper, by hand, while in the west the increased use of in-house company software has developed QFD specific applications. This is certainly true of Ford Motor Company (with QFDNET), Lucas Engineering (with TEAMSET), IBM International (with Dynamic QFD) and QFD process support companies such as the American Suppliers Institute (with QFD Designer) and ITI International (with QFD Capture) who supply their products to various companies worldwide. The use of software to develop QFD specific application may well be influencing the future adoption of QFD within the West in particular, and is an area that requires further research.

The mechanisation of the QFD charts may create further appeal on the formidable usefulness of this tool to Western audiences but the software QFD packages will not be a substitute for Quality Management in its entirety and the commitment towards customer satisfaction must always remain the key objective.

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