

Close Encounters of the QFD Kind

Glenn H. Mazur
QFD Institute
Japan Business Consultants, Ltd.
University of Michigan College of Engineering
Ann Arbor, Michigan

Abstract

Your customer's experience with your organization does not begin and end with a sale. Many other "encounters" occur during the promotion, sales, delivery, installation, service, support, and after market phases of the transaction. Customer needs during these encounters are all too often overlooked, yet can have a great impact on repeat sales and word-of-mouth advertising. Using customer needs gathered during the product development phase, we can use various cutting edge tools from Quality Function Deployment (QFD) to fulfill needs of other "encounters." Basic tools and a case study, with step-by-step instructions, are given.

Key Words

Customer Encounter Table, Customer Satisfaction, Kano, Marketing, QFD

Introduction

"I have bought three laptop computers from Toshiba in the last seven years," complains one power user, "but my next one will probably be an IBM." Due to Toshiba's leading edge technology, reliability, and innovative features, this customer has not been attracted by IBM as much as he has been chased away by his non-product encounters with Toshiba, which have become too frequent, time consuming, and egregious at the early learning curve phase of owning a leading edge model machine.

His experiences can be summed up in the following excerpt of a letter to the Vice President and General Manager of Toshiba America.

"The letdowns have been in trying to purchase your extended warranties and support, in trying to replace a defective power cord, in problems with your software support, and in problems with your peripherals. I have invested over \$6,000 in this unit with added memory, port replicator, and power accessories. Given the fine offerings of IBM lately, I will be hard pressed to make my next purchase a Toshiba."

In a competitive market, how much customer good will, future business, and word-of-mouth advertising was squandered by the non-product related encounters mentioned above? How could they have been avoided? How could customer satisfaction have been assured? For those product categories which have achieved a high level of meeting customer expectations, exceeding

those expectations may lie not as much in the “thing” itself, but in ancillary services that continue to support the purchase throughout its life.

Customer Service Interactions

Customer service interactions (CSI) (Parquette 1997) are opportunities that arise in pre- and post-sale activities to give customers proper attention, and subsequently align customer perception with the mission statements of the organization. While it is impossible to anticipate and train employees for every situation, the most critical and frequent ones should be predicted and preempted. Here are some examples of poor CSI; suggestions for these will follow later in the paper.

1. Toshiba’s extended computer warranty became urgent only as a work around for a defective power cord on a brand new unit. The retailer did not stock the cord and Toshiba’s standard warranty required sending the old one back first; which would have required at least 72 hours. The extended warranty, however, provided 24-hour on site service. For a traveling user of a portable unit, the standard wait was unacceptable.
2. The Delta Hotel chain in Canada took great pride in being the “first hotel on the information highway.” Their “office equipped” room even included a computer. Application software (word processor, spreadsheet etc.), however, was left up to the guest to install himself.
3. According to Hertz, all new cars are classified as “non-smoking” until someone smokes in them. Hertz employees will not guarantee a non-smoking vehicle.
4. The Westin Hotel, Copley Place Boston rewards its Premier® frequent guests with a breakfast allowance certificate, but staff at their premier restaurant do not know how to redeem them.

These are not examples of service employees having a bad day. Rather, they are examples of poor planning of ancillary services by management, with the results leaving customers with a perception less than the ideal portrayed in the “commitment to quality” posters and pamphlets festooned throughout the premises.

The customer service interaction can be very important in “commodity-like” businesses such as hotels and rental agencies, where the product itself may not offer as much an opportunity for competitive differentiation as how the product is delivered before and after the sale.

Does Nothing Wrong Mean Everything is Right?

Traditional approaches to assuring quality often focus on work standards (Love 1986), automation to eliminate human error-prone processes, and in more enlightened organizations, Quality Improvement Teams to empower employees to resolve problems.

As organizations are finding out, however, consistency and absence of problems are not enough of a competitive advantage after the market shakes out suboptimal players. For example, in the automobile industry, despite the celebrated narrowing of the “quality” (read that fit and

finish) gap between U.S. and Japanese makers, Japanese cars still win most of the top honors in the J.D. Powers Survey of New Car Quality. Suboptimal makers have all but disappeared from the North American market, the fit and finish of today's North American built vehicles are better than ever, but still the Japanese makes of Toyota, Nissan, and Honda go one step further to grab top honors.

QFD is quite different from traditional quality systems which aim at minimizing negative quality (such as poor service, broken product). With traditional systems, the best you can get is *nothing wrong* - which is no longer good enough. In addition to eliminating negative quality, we must also maximize positive quality (such as convenience, ease of use). This creates *value* which leads to customer satisfaction.

Quality Function Deployment is the only comprehensive quality system aimed specifically at satisfying the customer. It concentrates on maximizing customer satisfaction (positive quality) - measured by metrics such as repeat business. QFD focuses on delivering value by seeking out both spoken and unspoken needs, translating these into actions and designs, and communicating these throughout the organization. Further, QFD allows customers to prioritize their requirements, benchmark us against our competitors, and then direct us to optimize those aspects of our product and organization that will bring the greatest competitive advantage. What business can afford to waste limited financial, time and human resources on things customers don't want or where we are already the clear leader?

Are All Customer Requirements the Same?

To satisfy customers, we must understand how meeting their requirements effects satisfaction. There are three types of customer requirements to consider (see Figure 1) (Kano, et al 1984). *Revealed Requirements* are typically what we get by just asking customers what they want. These requirements satisfy (or dissatisfy) in proportion to their presence (or absence) in the product or service. Fast delivery would be a good example. The faster (or slower) the delivery, the more they like (or dislike) it. *Expected Requirements* are often so basic the customer may fail to mention them - until we fail to perform them. They are basic expectations without which the product or service may cease to be of value; their absence is *very* dissatisfying. Further, meeting these requirements often goes unnoticed by most customers. For example, if coffee is served hot, customers barely notice it. If it's cold or too hot, dissatisfaction occurs. Expected requirements *must* be fulfilled. *Exciting Requirements* are difficult to discover. They are beyond the customer's expectations. Their absence doesn't dissatisfy; their presence excites. For example, if caviar and champagne were served on a flight from Detroit to Chicago, that would be exciting. If not, customers would hardly complain. These are the things that wow the customers and bring them back. Since customers are not apt to voice these requirements, it is the responsibility of the organization to explore customer problems and opportunities to uncover such unspoken items.

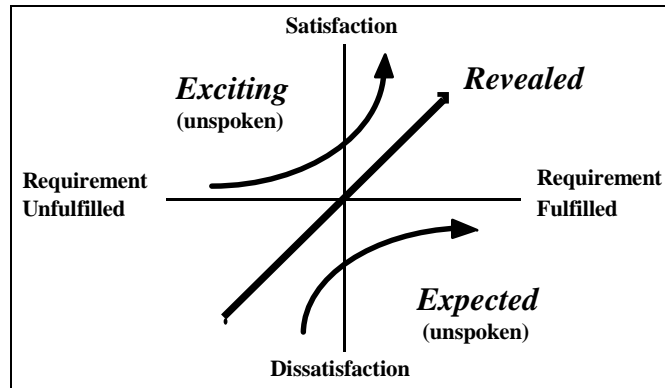


Figure 1. Kano Model (adapted). Products and services must meet all three types of requirements - not just what the customer says.

Kano's model is also dynamic in that what excites us today is expected tomorrow. That is, once introduced, the exciting feature will soon be imitated by the competition and customers will come to expect it from everybody. An example would be the ability to have pizza delivered in thirty minutes. On the other hand, expected requirements can become exciting after a real or potential failure. An example might be when the passengers applaud after a pilot safely lands the airplane in rough and stormy weather. The Kano Model has an additional dimension regarding which customer segments the target market includes. For example, the caviar and champagne that's exciting on the domestic flight might be expected on the Concorde from New York to London. Knowing which customer segments you want to serve is critical to understanding their requirements. Thus, eliminating problems is similar to meeting expected requirements. There is little satisfaction or competitive advantage when nothing goes wrong. Conversely, great value can be gained by discovering and delivering on exciting requirements ahead of the competition. QFD helps assure that expected requirements don't fall through the cracks and points out opportunities to build in excitement.

In summary, Kano found that the exciting needs, which are most tied to adding value, are unspoken and thus invisible to both the customer and the producer. Further, they change over time, technology, market segment, etc. The Voice of Customer analysis tools and techniques in the Appendix were created to break through this dilemma. Ancillary requirements fall into this category of unspoken needs and so a new Voice of Customer analysis tool, the Customer Encounter Table (CET) has been created. The CET is best created from direct interactions with and observations of the customer – the best source for customer data.

The Japanese have coined a word to describe this true source of information - they call it the *gemba*. The *gemba* is where the product or service becomes of value to the customer, that is, where the product actually gets used. It is in the *gemba* that we actually see who our customers are, what their problems are, how the product will be used by them, what supporting services are needed, etc. We go the *gemba* in QFD to see our customer's problems and opportunities as they happen. Unlike other customer information gathering techniques, such as focus groups, we do not ask questions about our problems with technology or marketing, we are not removed to an artificial site such as a meeting room (unless our product is tables and chairs), and we are not relying on customers' memories to report problems to us. Rather, we can employ all of our senses by using contextual inquiry, video taping, audio taping, direct observation, direct

現場

interviewing with customer's employees, etc. for the larger purpose of trying to understand how we can help our customers better conduct their business with *their* customers.

Going to the gemba requires planning. While paying customer visits is not new, books (McQuarrie 1993) on the subject are often long on advice and short on tools and techniques to maximize the value of such visits. QFD, as a quality based methodology, brings several tools together from the Seven Quality Control Tools (Brassard and Ritter 1994, JUSE 1991), the Seven Management and Planning Tools (Brassard and Ritter 1994, Mizuno 1988, Nayatani et al 1994), the Seven Product Planning Tools (Gustafsson 1996, Kanda 1994, Kanda 1995), and several specialized tools as will be described herein. A customer visit planning guide for using these tools has been developed by the author (Mazur 1995a, 1996) to assist in going to the gemba. See Appendix.

QFD and Voice of Customer Analysis

Quality Function Deployment has been used since 1966 to promote quality in new products and services. Unlike traditional quality tools that focus on *working out* current problems, QFD aims at the unknown problems that too often occur in new product development. Cost and time to market concerns make extensive testing difficult these days, and so a proactive method to *build in* customer satisfaction has been needed. Because of its strengths in focusing on new product development, the QFD model can be used to explore customer encounters in ancillary services, as well.

Depending on how the product or service is promoted, delivered, and supported, and to whom, there are many combinations of ancillary services. Knowing who the customer is and what they want is critical, but depending on the product or service, this may not be self evident. QFD has special tools to aid the process of making hidden needs visible to the design team. Some of these tools will be introduced in this paper.

Who is the customer?

A manufacturer of an industrial tool and consumables was surprised to learn that in addition to minor user oriented design modifications to their product, greater growth in market share lay in improving repair service turnaround time and avoiding consumable stockouts at the dealer level. They learned that in addition to improvements to the "thing" the users buy, there are sales opportunities in ancillary services that may involve other "customers" besides the end user. The chain of customers from the manufacturer or service provider to the end user or final customer is called the value chain. Opportunities to enhance customer satisfaction and profits exist at all points along the value chain, from distributors, to retailers, to installers, etc.

A common concern in QFD is focus – to reduce the time and expense of product development. It follows that some customers in the value chain and/or value chains in certain market segments may deserve our attention – and scarce resources – more than others. QFD analyzes these segments and customers using the following tools. Steps and examples to some of these tools are included in the Appendix.

The **Customer Segments Table** (Appendix) is used to map out potential end users. In this table, who uses the product or service, what they use it for, when they use it, where they use it, why they use it, and how they use it can be identified (Mazur 1997a). Prioritization of the cus-

tomer segments based on their importance to overall project or corporate goals can also be done to improve focus. (See **Project Success Criteria / Customer Segments Matrix** in Appendix.)

Once the segments are identified, customers along the value chain of selected segments can be analyzed using the **Customer Process Table** (Appendix). Each step in the process from production of the product through delivery to the end user can be analyzed, potential problems forecasted, and opportunities for improved satisfaction explored. This table helps see which links in the value chain offer the most opportunities for improvement.

Going to *gemba*

To fully understand the needs of the customer, we must see first hand the kinds of problems the customer is having with his life and business. In going about their everyday business, what barriers to accomplishing their tasks or achieving satisfaction do they face? What opportunities would they like to seize, what dreams fulfill, but for lack of something – that your organization could potentially provide? As Dr. Kano pointed out above, many of these issues are going to be invisible to outside observers, especially when they remain outside. Since customers may not put these needs into words, observation of the customer “at work” is an excellent way to learn more. This is best done by going to the *gemba* (Mazur 1996).

Analyzing Customer Needs

Customer needs gain their meaning from the context in which they are spoken or observed. For example, a customer who exits a cafeteria line without a purchase might have a need to put their luggage down first to free their arms or reserve a table if they are in an airport cafeteria, might exit a shopping mall cafeteria because none of the food looked appetizing. Capturing the context of the *gemba* at which the observation is made or words spoken creates a record of the encounter and allows development team members who were not present to better understand the customer. The **Customer Context Table** (Appendix) is used to record this data. This table records the *gemba* context, the spoken words and our observations of the customer, and helps the team extract detailed requirements expressed in singular statements.

These requirements statements are usually a mixture of needs for ease of use, functionality, performance levels, failures to be avoided, sprinkled with the customer’s opinion of how you should solve them. In QFD, these statements are separated and deployed differently, first by whether they express a benefit to the customer or a feature of the product or service. For example, Wiremold (Blondin), a manufacturer of electrical conduit, frequently heard customers say “I want a variety of colors to choose from.” This expresses a feature of the product, specifically number of colors available. In QFD, we also want to know the benefit the customer expects to gain should he get his “color.” After a QFD analysis, it turned out that customers really wanted the surface mounted electrical conduit to “look good in the office” and that rather than going through the costs of developing and stocking a wide range of colors, traditional “computer beige” fit nearly every application. One expression, then, of the *true* benefit to the customer is that “it looks good in my office.” The **Customer Voice Table** (Appendix) is used for this task.

The Customer Voice Table has typically been used to more deeply analyze customer needs for the product or service being sold to the end user. Here, we will expand the table to include ancillary services as well. I call this the **Customer Encounter Table**.

Customer Encounter Table

Step 1. Begin by documenting each encounter the customer has with the product. There are many ways to do this: a list, a simple flow chart, **Customer Process Table** (Appendix), **State Transition Diagram** (Appendix, Mazur 1995b), **Affinity Diagram** and **Hierarchy Diagram** (Appendix), or a similar process may be used.

Step 2. Create a table with customer encounters in the rows and customer benefit statements from the Customer Voice Table (called demanded quality in QFD) in the columns. The axes may be reversed for ease of formatting.

Optionally, time may be saved by limiting the items in the table to only those most critical to customers. There are a number of ways to determine criticality. Have customers prioritize the encounters and/or the benefit statements, and only include the highest weighted ones. This makes the table smaller but you limit opportunities to customers' response at one point in time. Methods to do this include:

1. **Analytic Hierarchy Process** (Appendix, Saaty). Most accurate prioritization based on using paired comparisons to yield true ratio scale prioritization. Traps inconsistencies in judgements.
2. Quality Planning Table from the House of Quality (Mazur 1996). Comprehensive prioritization based on customer importance, competitiveness, and product strategy, but mathematics are suspect. Can be started midway in the House of Quality phase.
3. **Preplanning Matrix** in four-phase QFD (Hoffmeister et al). Simple high-low rating system and graphical display of competitiveness. Limited accuracy.
4. **Voice of Value Table** from CIDM/QFD (Daetz et al). Pulls together the best of the above methods, but use of percentages is not as accurate as Analytic Hierarchy Process. Can be done earlier in QFD process than Quality Planning Table but does not use competitiveness and product strategy in its calculations. More accurate than the Preplanning Matrix.

Step 3. Reword the benefit statement from the product or service to be consistent with the customer encounter. For example, if the product benefit is "Easy to use," and the encounter is when placing an order, the corresponding rewording would be "Easy to place an order."

Step 4. Deploy improvements using standard QFD deployments (Mazur 1996) or Customer Satisfaction Story (Mazur 1994). Creativity tools such as deBono (deBono) or TRIZ (Mazur 1996) often lead to unique and exciting solutions.

While the process is common sense and simple, in most organizations, the design of the product and design of ancillary services such as order entry are done by completely different departments that infrequently communicate on issues regarding customer satisfaction. The Customer Encounter Table is a systematic way to bridge this gap. Additional requirements can also be explored by substituting different parts of the sentence, for example, "easy to place an order" could become "easy to change an order," or "easy to change the credit card number."

Table 1. Customer Encounter Table for Industrial Tool

	Product Requirement	Broad range of consumables.	No down time due to tool or consumables problems.
Promotion	Advertising	Advertising reaches different customer segments.	
	Catalogs and literature	Broad range of advertising materials for dealers.	Don't run out of catalogs or price sheets.
	Research	Market research done with wide range of customers.	
Sales	Contact	Salesman has broad knowledge of products.	I don't have to wait for a salesman to place an order.
	Follow through	Any person in the company can answer my questions.	No delays due to lost orders.
	Follow up	Any person in the company can help me with my account.	No delays due to wrong product shipped.
Delivery	Timing	Variety of shipping options to meet my timing needs.	No wait for order to arrive.
	Extent of delivery service offered	Will deliver even small orders.	No waiting for minimum order quantities.
	Location	Extensive delivery area.	No waiting for orders to my area to be scheduled.
Installation	Assistance	Variety of extra services available to help us use tools.	No waiting for help in getting tools working.
	Clean up		
	Timing		
Operation	Manuals	Manuals available in several languages.	No waiting for extra manuals.
	Videos	Videos available for wide range of tool usage.	No wait to receive videos.
	Help Desk/Problem handling	All problems can be answered through one number.	No wait to talk to technician.
Service	Left blank intentionally.		
Contact			
Timing			
Quality			
Clean up			
Damage			
Follow up			

About Those Customer Service Interactions

At the beginning of this paper, four poor customer service interactions were introduced. Here is how the author would approach them.

1. Toshiba caters to the high power traveling computer user. Their equipment is high end, leading edge technology, and expensive. They may travel to different locations each day, do much of their computer work in hotels at night, and have no time to deal with equipment problems. Toshiba supports their computing needs with fine hardware, and when a customer needs after-hours support or instant delivery of a part or accessory, they expect Toshiba to deliver equally as well. A customer should find their most experienced technical support people on night duty, their parts people opened even at inventory and holiday times, and always able to offer next day delivery of critical parts such as power supplies or replacement software, even if from a nearby dealer's inventory if necessary.
2. The Delta Hotels saw an opportunity to beat their competition in a new trend in business customer needs – the office guest room. The hotel aspects of the room such as an office chair, convenient power and phone outlets, good desk and lighting, etc. were great. But the sales point was the computer, the link to the “information highway.” Someone familiar with the computing needs of business travelers should have been involved with the planning, so that the most common software was installed and working on the machines. Business customers should not have been expected to carry their own floppy disks and spend hours installing and setting up software.
3. The risks of second hand smoke are well known, as are the wishes of many customers like the author to have a smoke-free environment. According to Hertz's central reservation line and site managers, there is no guarantee of a request for a non-smoking vehicle being honored. Apparently, all new vehicles are classified non-smoking until they are smoked in. They should designate some vehicles as smoking from the outset and others as non-smoking and then enforce the distinction with both customers and their own employees. Further, when a customer is insistent, they should designate an on-site non-smoker to sniff the vehicle prior to delivery. Since all the major car rental agencies offer similar prices for similar vehicles, here is one way for Hertz to gain a competitive advantage with an ancillary service.
4. The Westin Copley Place goes to great lengths to treat its Premier guests special. Room upgrades, extra amenities abound for these frequent guest club members. It is vital that all hotel employees understand these amenities, such as a free breakfast allowance certificates, so that guests feel welcome, rather than having to argue to explain the program to the hotel's own restaurant staff.

Conclusion

It is important to recognize that many customer needs are in the areas of expectations and excitors that are often unvoiced by the customer. Further, many of these needs are outside the areas typically researched in new product development – i.e. the product itself. In many businesses today, competitive advantage can lie outside improvements in just the product or service being sold. Since customers seldom are asked about their needs in these ancillary services and the managers who create these services are not typically involved in the product development process,

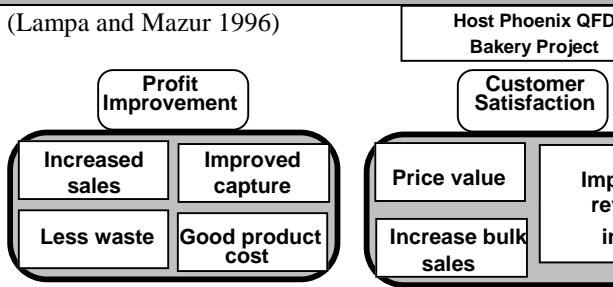
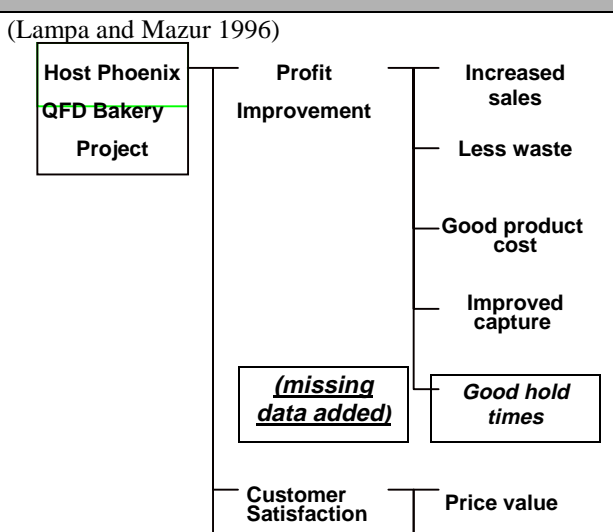
few organizations have a systematic approach to assuring their quality. The Customer Encounter Table coupled with other QFD tools and techniques can be a powerful tool in improving customer satisfaction throughout the entire customer service interaction.

About the Author

Glenn H. Mazur has been active in QFD since its inception in North America, and has worked extensively with the founders of QFD on their teaching and consulting visits from Japan. His primary focus is in the service industry, as a manager for over 15 years in automobile repair and parts warehousing, as a teacher, and as an owner of a translating and consulting business he started in 1982. He is one of North America's leaders in the application of QFD to service industries, sits on several advanced QFD research committees, and sits on the steering committee of the Symposium on Quality Function Deployment held annually in Detroit. He is also Executive Director of the non-profit QFD Institute and an Adjunct Lecturer of Total Quality Management at the University of Michigan College of Engineering. He lectures and trains in QFD worldwide.

Mazur holds a Master's Degree in Business Administration and a Bachelor's Degree in Japanese Language and Literature, both from the University of Michigan. Comments and suggestions are welcomed via email at QFDI@qfdi.org.

Appendix (Mazur 1997b)

Task	Tool	Purpose	Step-by-step Instructions	Case Study
<p>1. Define and prioritize project success criteria.</p> <ul style="list-style-type: none"> This aligns to same goals, team members who work for different functional bosses. Develop selection criteria for determining to which gemba to go. 	<p>Brainstorming (Brassard and Ritter 1994)</p>	<p>Quickly generate ideas in a process that promotes discussion without criticism.</p>	<ol style="list-style-type: none"> Define goal (not action) statements with clear measurable targets, measurement method, and deadline. Common goals are profit, ROI, market share, utilization of capacity, time to market, etc. 	<p>Increase customer satisfaction as measured by J.D. Powers and Associates from 13th place to 5th place by 2000</p>
	<p>Affinity Diagram (Brassard and Ritter 1994, Mizuno 1988, Nayatani et al 1994)</p>	<p>Reveal underlying structure of ideas. Rather than pre-determine categories and slot ideas into them, this allows ideas themselves to form natural groupings.</p>	<ol style="list-style-type: none"> Write each criterion on a Post-It™ Note. Arrange silently into clusters based on a shared affinity Discuss header cards to represent each cluster. Grouping groups is permitted. 	<p>(Lampa and Mazur 1996)</p> 
	<p>Hierarchy Diagram (Tree) (Brassard and Ritter 1994, Mizuno 1988, Nayatani et al 1994)</p>	<p>To refine Affinity Diagram groupings in terms of overlap between levels of abstraction, and to identify missing ideas.</p>	<ol style="list-style-type: none"> Lay Affinity Diagram out left to right with most abstract level to the left. Adjust hierarchy nodes so that they represent same degree of abstraction at each level. Nodes at each level should be mutually exclusive. For each node, review leaves and add any missing items. For each node, leaves should represent collectively exhaustive set. 	<p>(Lampa and Mazur 1996)</p> 

Task	Tool	Purpose	Step-by-step Instructions					Case Study					
	Analytic Hierarchy Process (Matrix) (Saaty 1990, Zultner 1993)	AHP uses pair-wise comparisons to measure importance and yields ratio scale priorities. These are more accurate than other prioritization methods such as rank order since they show distance between values, and can be mathematically manipulated.	<ol style="list-style-type: none"> 1. Create a matrix with the same data in both the rows and columns. This can be done for each node and its leaves immediately to the right. In the case study, only the most abstract level is illustrated. 2. Compare each pair of data in terms of importance on a one to nine scale, with one meaning equal in importance and nine meaning the row is extremely more important than the column. The diagonal is all ones and the numbers below the diagonal are the inverse of numbers above the diagonal. 3. Normalize columns and then add the normalized values across the rows and normalized again to yield the ratio scale % of priority. 4. When team members cannot agree on the degree of importance, the geometric average of their votes is entered into the matrix instead. In other words, neither the team nor the managers have to agree for the process to yield accurate results. Saaty has software that does this easily. 										
AHP Case Study (Lampa and Mazur 1996)		CS	AS	LL	PI	WR	NORMALIZED COLUMNS					ROW SUM	%
							CS	AS	LL	PI	WR		
CUSTOMER SATISFACTION (CS)		1	5	9	5	9	0.62	0.77	0.45	0.44	0.27	2.55	50.9%
ASSOCIATE SATISFACTION (AS)		0.2	1	5	5	9	0.12	0.15	0.25	0.44	0.27	1.24	24.8%
LANDLORD SATISFACTION (LL)		0.11	0.2	1	0.2	5	0.07	0.03	0.05	0.02	0.15	0.32	6.3%
PROFIT IMPROVEMENT (PI)		0.2	0.2	5	1	9	0.12	0.03	0.25	0.09	0.27	0.76	15.3%
WIN & RETAIN CONTRACTS (WR)		0.11	0.11	0.2	0.11	1	0.07	0.02	0.01	0.01	0.03	0.13	2.7%
TOTALS		1.62	6.51	20.20	11.31	33.00	1.00	1.00	1.00	1.00	1.00	5.00	100.0%

Task	Tool	Purpose	Step-by-step Instructions	Case Study																								
<p>2. Define and apply selection criteria to key market segments.</p> <ul style="list-style-type: none"> • QFD team can define both current and unknown potential markets. • Team can identify most promising customer segments. • Team can apply limited resources of time, people, and money to most promising customers first. 	<p>Customer Segment Table. (Daetz et al 1995 Ch. 9, Mazur and Zultner 1996)</p>	<p>QFD team can quickly identify both use and demographic data about potential customer segments, and then quickly identify most important segments.</p>	<ol style="list-style-type: none"> 1. Create a table with 5W1H column headers of who will use product/service, what will they use it for, when will they use it, where will they use it, why will they use it, how will they use it. Other categories can be added as needed to define the customer segments. 2. In each column, list as many items as possible, including any market research data on market size, sales, % etc. for each item. 3. Circle promising characteristics of each customer and link together in a chain to profile a customer segment. Try to identify 10-15 promising customer segments this way. 	<table border="1"> <thead> <tr> <th data-bbox="1270 191 1388 220">Who</th> <th data-bbox="1388 191 1478 220">What</th> <th data-bbox="1478 191 1568 220">When</th> <th data-bbox="1568 191 1659 220">Where</th> <th data-bbox="1659 191 1776 220">Why</th> <th data-bbox="1776 191 1879 220">How</th> </tr> </thead> <tbody> <tr> <td data-bbox="1270 220 1388 412">Business travelers 60% of airport traffic</td> <td data-bbox="1388 220 1478 412">Breakfast 75%</td> <td data-bbox="1478 220 1568 412">am weekdays 60%</td> <td data-bbox="1568 220 1659 412">eat at kiosk 10%</td> <td data-bbox="1659 220 1776 412">in hurry no time to stop on way to airport 30%</td> <td data-bbox="1776 220 1879 412">eat plain 15%</td> </tr> <tr> <td data-bbox="1270 412 1388 604">Leisure travelers 20% of airport traffic</td> <td data-bbox="1388 412 1478 604">Lunch 5%</td> <td data-bbox="1478 412 1568 604">pm weekdays 15%</td> <td data-bbox="1568 412 1659 604">eat in departure lounge 65%</td> <td data-bbox="1659 412 1776 604">transferring flights during a meal time 25%</td> <td data-bbox="1776 412 1879 604">eat with shopping 85%</td> </tr> <tr> <td data-bbox="1270 604 1388 795">Greeters and meeters 15% of airport traffic</td> <td data-bbox="1388 604 1478 795">Snack 20%</td> <td data-bbox="1478 604 1568 795">week-ends 20%</td> <td data-bbox="1568 604 1659 795">carry on board 25%</td> <td data-bbox="1659 604 1776 795">no food on airplane 45%</td> <td></td> </tr> </tbody> </table> <p>(Zultner and Mazur 1996.)</p>	Who	What	When	Where	Why	How	Business travelers 60% of airport traffic	Breakfast 75%	am weekdays 60%	eat at kiosk 10%	in hurry no time to stop on way to airport 30%	eat plain 15%	Leisure travelers 20% of airport traffic	Lunch 5%	pm weekdays 15%	eat in departure lounge 65%	transferring flights during a meal time 25%	eat with shopping 85%	Greeters and meeters 15% of airport traffic	Snack 20%	week-ends 20%	carry on board 25%	no food on airplane 45%	
Who	What	When	Where	Why	How																							
Business travelers 60% of airport traffic	Breakfast 75%	am weekdays 60%	eat at kiosk 10%	in hurry no time to stop on way to airport 30%	eat plain 15%																							
Leisure travelers 20% of airport traffic	Lunch 5%	pm weekdays 15%	eat in departure lounge 65%	transferring flights during a meal time 25%	eat with shopping 85%																							
Greeters and meeters 15% of airport traffic	Snack 20%	week-ends 20%	carry on board 25%	no food on airplane 45%																								

Task	Tool	Purpose	Step-by-step Instructions	Case Study																																																																											
	<p>Project Success Criteria / Customer Segments Matrix (Zultner 1992, 297-319, Mazur 1995a)</p> <p>Variations of this are the Project Success Criteria / Core Competencies Matrix and the Core Competencies / Customer Segments Matrix (Mazur 1993).</p>	<p>The project success criteria are used to prioritize the customer segments to further focus on key customers' gembas.</p> <p>The approach here is that scarce customer visit resources should be applied first to customers most likely to help our project succeed, and to satisfy their needs first.</p>	<ol style="list-style-type: none"> Put the hierarchy and weights from the AHP of the project success criteria into the rows of a relationship matrix (Brassard and Ritter 1994, Mizuno 1988, Nayatani et al 1994). Put the 10-15 most promising customer profiles into the columns. Working row by row, identify the degree of contribution each customer profile has to each project success criteria. Enter a value of 0-9, with 9 being strongest in the intersecting cells. A variation of this is to use the QFD symbols (and points) of ⊙ (9), ○ (3), Δ (1). Multiply the AHP weights by the strength of contribution values in each cell, and sum the products of these multiplications for each columnar customer segment. Normalize to a percentage. Apply time, people, and money resources in proportion to the customer segment weights to making customer gemba visits. An alternative is to pick the highest weighted customers and ignore the others. 	<p>Japan Business Consultants, Ltd. (Mazur 1995a) Organization Goals vs Customer Segments</p> <p>Date: 23 Oct 93 c:\qfd\jbcqfd\capdata\goalcust</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Strong Relationship: ⊙ 9 Medium Relationship: ○ 3 Weak Relationship: Δ 1</p> </div> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Customer Segments</th> <th>Automotive industry</th> <th>Exporters</th> <th>Management consultants</th> <th>Translation agencies</th> <th>Government</th> <th>Japanese in U.S.</th> <th>Org. Goal Wt.</th> </tr> </thead> <tbody> <tr> <td>Organization Goals</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Financial independence</td> <td></td> <td></td> <td></td> <td>○</td> <td>⊙</td> <td></td> <td></td> <td>49.5</td> </tr> <tr> <td>Exploit expertise</td> <td></td> <td>○</td> <td></td> <td>⊙</td> <td></td> <td></td> <td></td> <td>39.4</td> </tr> <tr> <td>Control of time</td> <td></td> <td></td> <td></td> <td>⊙</td> <td></td> <td>○</td> <td></td> <td>4.6</td> </tr> <tr> <td>Gain knowledge</td> <td></td> <td></td> <td>Δ</td> <td>Δ</td> <td>○</td> <td>⊙</td> <td></td> <td>6.5</td> </tr> <tr> <td>Abs. Wt.</td> <td>7</td> <td>118</td> <td>7</td> <td>11</td> <td>190</td> <td>45</td> <td>807</td> <td>2</td> <td>33</td> <td>622</td> </tr> <tr> <td>Cust. Seg. Wt.</td> <td></td> <td>7</td> <td>0</td> <td>11</td> <td>45</td> <td>2</td> <td>33</td> <td>35</td> <td></td> </tr> </tbody> </table>		Customer Segments	Automotive industry	Exporters	Management consultants	Translation agencies	Government	Japanese in U.S.	Org. Goal Wt.	Organization Goals									Financial independence				○	⊙			49.5	Exploit expertise		○		⊙				39.4	Control of time				⊙		○		4.6	Gain knowledge			Δ	Δ	○	⊙		6.5	Abs. Wt.	7	118	7	11	190	45	807	2	33	622	Cust. Seg. Wt.		7	0	11	45	2	33	35	
	Customer Segments	Automotive industry	Exporters	Management consultants	Translation agencies	Government	Japanese in U.S.	Org. Goal Wt.																																																																							
Organization Goals																																																																															
Financial independence				○	⊙			49.5																																																																							
Exploit expertise		○		⊙				39.4																																																																							
Control of time				⊙		○		4.6																																																																							
Gain knowledge			Δ	Δ	○	⊙		6.5																																																																							
Abs. Wt.	7	118	7	11	190	45	807	2	33	622																																																																					
Cust. Seg. Wt.		7	0	11	45	2	33	35																																																																							
<p>3. Go to the Gemba.</p> <ul style="list-style-type: none"> Walk a mile in your customer's shoes to under- 	<p>Check list. (McQuarrie 1993, 160-162, Mazur 1995a)</p>	<p>Assure that customer visit is well planned (see Table 1 above).</p>	<p>8. Determine team members. Have at least one inside and one outside person. Set roles and responsibilities, including observer, re-</p>	<p>I.Set objectives (Plan)</p> <p>A.Kinds of information you want to collect</p> <p>1. clear, agreed upon objectives</p>																																																																											

Task	Tool	Purpose	Step-by-step Instructions	Case Study																																																																													
<p>stand how he does business, what his customers need, and what problems he has satisfying their needs.</p>			<p>order, lead talker, etc.</p> <ol style="list-style-type: none"> 9. Determine who in the customer's business, home, etc. you need to visit, and arrange time appropriately. 10. Determine what equipment will be needed to capture voice of customer, and become familiar with using it. 11. Make plans for debriefing other teams. 12. Rehearse with safe "customers" such as employees. 	<ol style="list-style-type: none"> 2.non-conflicting 3.limited number 4.not a sales call <p>B.Prioritize visit objectives</p> <ol style="list-style-type: none"> 1 .Analytic Hierarchy Process (AHP) <p>From Customer Visits Implementation Guide (Mazur 1995a)</p>																																																																													
	<p>Flow Charts, Fault Tree Analysis. Customer Process Table. (Nelson 1992)</p>	<p>Diagram your customer's issues and processes.</p>	<ol style="list-style-type: none"> 1. Visit customer's gemba and discuss/observe customer's work and processes. 2. Map customer's processes. 3. Look for deviations, potential failures in customer's processes. 4. Uncover implied customer needs. 5. Clarify customer's functions and subsystems that perform those functions. <p>Propose new concepts to perform those functions better than customer's current methods.</p>																																																																														
				<table border="1"> <caption>Customer Process Table for Unit Installation</caption> <p style="text-align: right;">Rev Date 9/24/92</p> <thead> <tr> <th colspan="3">Customer Process</th> <th rowspan="2">Deviations in Customer Process</th> <th rowspan="2">Implied Customer Needs</th> <th colspan="3">Product</th> </tr> <tr> <th>Supplier</th> <th>Warehouse</th> <th>Installer</th> <th>Functions (Total Product)</th> <th>Subsystems</th> <th>Concepts</th> </tr> </thead> <tbody> <tr> <td>shipment</td> <td></td> <td>Store units</td> <td></td> <td>Receive many revision levels</td> <td>works the way it is supposed to few changes in the product</td> <td>(basic function)</td> <td>Unit</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Each revision level configures differently</td> <td>keep me informed of changes in the product</td> <td>(basic function)</td> <td>Unit</td> <td>Conversation with key customer contact people</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Configuration requires documentation</td> <td>easy to remember how to use product</td> <td></td> <td>Unit</td> <td>(Internal consistency as a concept selection criterion)</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Documentation is not available at installation</td> <td>easy to configure</td> <td>Adapt unit to application</td> <td>Unit</td> <td>Auto configuration (no doc. required)</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td>have the information I need to install the unit</td> <td></td> <td>Documentation</td> <td>Quick ref. sticker on unit</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td>easy to follow instructions</td> <td></td> <td>Unit</td> <td>Color code for config. on unit (removes need for documentation)</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Documentation</td> <td>Conduct pilot test of instructions</td> </tr> </tbody> </table>	Customer Process			Deviations in Customer Process	Implied Customer Needs	Product			Supplier	Warehouse	Installer	Functions (Total Product)	Subsystems	Concepts	shipment		Store units		Receive many revision levels	works the way it is supposed to few changes in the product	(basic function)	Unit						Each revision level configures differently	keep me informed of changes in the product	(basic function)	Unit	Conversation with key customer contact people					Configuration requires documentation	easy to remember how to use product		Unit	(Internal consistency as a concept selection criterion)					Documentation is not available at installation	easy to configure	Adapt unit to application	Unit	Auto configuration (no doc. required)						have the information I need to install the unit		Documentation	Quick ref. sticker on unit						easy to follow instructions		Unit	Color code for config. on unit (removes need for documentation)								Documentation	Conduct pilot test of instructions
Customer Process			Deviations in Customer Process	Implied Customer Needs	Product																																																																												
Supplier	Warehouse	Installer			Functions (Total Product)	Subsystems	Concepts																																																																										
shipment		Store units		Receive many revision levels	works the way it is supposed to few changes in the product	(basic function)	Unit																																																																										
				Each revision level configures differently	keep me informed of changes in the product	(basic function)	Unit	Conversation with key customer contact people																																																																									
				Configuration requires documentation	easy to remember how to use product		Unit	(Internal consistency as a concept selection criterion)																																																																									
				Documentation is not available at installation	easy to configure	Adapt unit to application	Unit	Auto configuration (no doc. required)																																																																									
					have the information I need to install the unit		Documentation	Quick ref. sticker on unit																																																																									
					easy to follow instructions		Unit	Color code for config. on unit (removes need for documentation)																																																																									
							Documentation	Conduct pilot test of instructions																																																																									

(Nelson 1992, 322)

(Nelson 1992, 325)

Task	Tool	Purpose	Step-by-step Instructions	Case Study
	<p>State Transition Diagram (STD). (Gane and Sarson 1977, Mazur 1995b)</p>	<p>Captures the customer's logic as states he passes through in the use of a product or service. Identifies events that can trigger customer needs.</p>	<ol style="list-style-type: none"> In each box write the current state with an arrow pointing to the desired state. On each arrow, write above the line the event triggering the change of state and below the line the process that takes place after the event occurs. 	<p>Part of STD for cafeteria (Mazur 1995b)</p>
	<p>Data Flow Diagram (DFD). (Gane and Sarson 1977, Mazur 1995b)</p>	<p>The data flow diagram allows a process to be displayed at a logical level (everything a customer sees) without committing to a constraining physical implementation. Since customers will make decisions based on some knowledge (data), the DFD can help us understand influencing factors.</p>	<ol style="list-style-type: none"> Draw double squares to indicate source of data. Draw arrows to show the flow of data. Draw a circle to show the process which uses the data (could come from the STD). An open rectangle shows store of data. Capture the complexities the customer manages in their decision making process, so that ways to influence that decision can be devised. Organize the STD and DFD data with other software-derived tools such as an Event Table and Event Tree (Mazur 1995b). 	<p>DFD for selecting a restaurant (Mazur 1995b).</p>

Task	Tool	Purpose	Step-by-step Instructions	Case Study																																
	<p>Customer Context Table (CCT).</p> <p>Verbatim Translation Table (VTT) (Ohfuji et al 1990. Marsh et al 1991), Mazur 1995a, Mazur and Zultner 1996)</p>	<p>CCT records the context of use of the product or service. Useful for understanding environment and other issues related to reliability and robust design, and setting performance targets in the House of Quality.</p> <p>Sometimes combined with VTT to translate words and observations to reveal unspoken customer needs.</p>	<ol style="list-style-type: none"> Enter information about each customer and gemba on a separate sheet. Record context of use such as who uses it, what for, when, where, why, how, etc. Capture spoken and observed “verbatim” as accurately as possible. Translate each verbatim into unique expressions of customer requirements. Feel free to extrapolate as we are not concerned at this point with preference, importance, or likelihood, which will be measured later in the Quality Planning Table in the House of Quality. 	<p>CCT and VTT for Automobile Muffler.</p> <table border="1"> <thead> <tr> <th>Verbatim</th> <th>Who</th> <th>What</th> <th>When</th> <th>Where</th> <th>Why</th> <th>How</th> <th>Translated Data</th> </tr> </thead> <tbody> <tr> <td>Hi performance, but car sounds quiet.</td> <td>40 year old mail office worker</td> <td>commute</td> <td>mornin g, evenin g</td> <td>high way</td> <td>go to work</td> <td>car pool</td> <td>Accelerates quickly. Good gas mileage. Car is quiet. Engine is quiet. Absorbs</td> </tr> <tr> <td>Muffler doesn't rust out.</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Muffler doesn't rust out. Pipes</td> </tr> <tr> <td>Starts easily when cold.</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Starts easily when cold. Starts easily when wet. Can drive off immediately</td> </tr> </tbody> </table>	Verbatim	Who	What	When	Where	Why	How	Translated Data	Hi performance, but car sounds quiet.	40 year old mail office worker	commute	mornin g, evenin g	high way	go to work	car pool	Accelerates quickly. Good gas mileage. Car is quiet. Engine is quiet. Absorbs	Muffler doesn't rust out.							Muffler doesn't rust out. Pipes	Starts easily when cold.							Starts easily when cold. Starts easily when wet. Can drive off immediately
Verbatim	Who	What	When	Where	Why	How	Translated Data																													
Hi performance, but car sounds quiet.	40 year old mail office worker	commute	mornin g, evenin g	high way	go to work	car pool	Accelerates quickly. Good gas mileage. Car is quiet. Engine is quiet. Absorbs																													
Muffler doesn't rust out.							Muffler doesn't rust out. Pipes																													
Starts easily when cold.							Starts easily when cold. Starts easily when wet. Can drive off immediately																													
<p>4. Analyze Gemba Data.</p> <ul style="list-style-type: none"> The data gathered with the above tools is then analyzed for missing data, structured for later deployments, prioritized, and benchmarked. 	<p>Customer Voice Table (CVT). (Ohfuji et al 1990. Marsh et al 1991), Mazur 1995a, Mazur and Zultner 1996)</p>	<p>“Customers buy benefits, producers make features,” goes the old marketing saw. The CVT is used to determine if the gemba data represents the true need or benefit the customer, or an engineering description of performance, functionality, technology, solution, price, etc.</p>	<ol style="list-style-type: none"> Review each piece of gemba data from the above tools. They should be unique, not compound expressions of requirements. If the data is a qualitative expression of customer benefit, it is called “demanded quality” and is placed in the appropriate column on the CVT. If the data describes a measurable level of performance, a function, a failure, a solution or methodology, price or cost, etc. put it in the appropriate feature column for later deployment in Comprehensive QFD. For each feature, look for missing demanded quality items that underlie the feature. 	<table border="1"> <thead> <tr> <th>Demanded Quality</th> <th>Performan</th> <th>Function</th> <th>Reliability</th> <th>Misc</th> </tr> </thead> <tbody> <tr> <td>Car accelerates quickly <i>Music sounds good.</i> ← <i>DQ added</i> Good gas mileage Car operates quietly Engine operates quietly Starts easily when cold Starts easily when wet Can drive away immediately</td> <td></td> <td>Absorbs vibration</td> <td>Muffler doesn't rust out Pipes don't rust out Muffler is attached securely</td> <td></td> </tr> <tr> <td>Starts easily anytime Muffler emits no odor</td> <td>Distance from windows</td> <td>Carry exhaust</td> <td>Muffler doesn't rust out Muffler doesn't leak fumes Muffler</td> <td></td> </tr> </tbody> </table>	Demanded Quality	Performan	Function	Reliability	Misc	Car accelerates quickly <i>Music sounds good.</i> ← <i>DQ added</i> Good gas mileage Car operates quietly Engine operates quietly Starts easily when cold Starts easily when wet Can drive away immediately		Absorbs vibration	Muffler doesn't rust out Pipes don't rust out Muffler is attached securely		Starts easily anytime Muffler emits no odor	Distance from windows	Carry exhaust	Muffler doesn't rust out Muffler doesn't leak fumes Muffler																		
Demanded Quality	Performan	Function	Reliability	Misc																																
Car accelerates quickly <i>Music sounds good.</i> ← <i>DQ added</i> Good gas mileage Car operates quietly Engine operates quietly Starts easily when cold Starts easily when wet Can drive away immediately		Absorbs vibration	Muffler doesn't rust out Pipes don't rust out Muffler is attached securely																																	
Starts easily anytime Muffler emits no odor	Distance from windows	Carry exhaust	Muffler doesn't rust out Muffler doesn't leak fumes Muffler																																	

Task		Tool		Purpose		Step-by-step Instructions		Case Study	
						<p>derlie the feature.</p>			
<p>Demanded Quality Affinity Diagram and Hierarchy Diagram (Tree).</p>		<p>The Affinity Diagram is used to uncover the underlying structure of the Demanded Quality from the customers' point of view. The Tree is used to correct the structure and look for more missing data.</p>		<p>See detailed instructions above.</p>					
<p>Quality Planning Table. (Mazur 1995a)</p>		<p>This is the right hand room of the House of Quality where the Demanded Qualities are prioritized.</p>		<ol style="list-style-type: none"> 1. Use modal survey data or AHP to determine rate of importance. 2. Enter survey data on customer view of competitive alternatives. 3. Set improvement targets, sales points, calculate % priorities. 					

References

- Blondin, S. et al. 1994. We Designed It Right With Our Ears. In *Transaction from the Sixth Symposium on Quality Function Deployment*. Novi, MI. pp. 455-463. ISBN1-889477-06-0
- Brassard, Michael and Diane Ritter. 1994. *The Memory Jogger II*. Methuen, MA: GOAL/QPC.
- Daetz, Douglas, William Barnard, Richard Norman. 1995. *Customer Integration: The Quality Function Deployment (QFD) Leader's Guide for Decision Making*. New York: John Wiley & Sons, Inc.
- deBono, Edward. 1992. *Serious Creativity*. New York: Harper Business. ISBN 0-88730-566-0
- Gane, Chris and Trish Sarson. 1977. *Structured Systems Analysis: Tools and Techniques*. New York: Improved System Technologies, Inc.
- Gustafsson, Anders. 1996. *Customer Focused Product Development by Conjoint Analysis and QFD*. Linköping, Sweden: Linköping Studies in Science and Technology Dissertation No. 418.
- Hoffmeister, Kurt and Bill Slabey. 1992. QFD Primer - Excerpts from the QFD Course Manual. *Transactions from the Fourth Symposium on Quality Function Deployment*. Novi, MI. ISBN1-889477-04-4
- JUSE. 1991. *TQC Solutions: the 14-Step Process*. Portland, OR: Productivity Press.
- Kanda, Noriaki et al. 1994. The Seven Product Planning Tools for New Product Development. *Hinshitsu Kanri* 45-46(July 1994-May, 1995). (Series of Japanese articles translated into English for QFD Institute Master Class 1995).
- Kanda, Noriaki et al. 1995. *The Seven Product Planning Tools: A Tool Set for New Product Development*. Tokyo: JUSE Press. (in Japanese).
- Kano, Noriaki, Nobuhiko Seraku, Fumio Takahashi, and Shinichi Tsuji. 1984. Attractive Quality and Must-Be Quality. *Hinshitsu* 14, no. 2. (February): 39-48.
- Lampa, Steve and Glenn Mazur. 1996. Bagel Sales Double at Host Marriott Using Quality Function Deployment. *Transactions of the Eight Symposium on Quality Function Deployment*. Ann Arbor, MI: QFD Institute.
- Love, John F. 1986. *McDonald's: Behind the Arches*. Toronto: Bantam Books.
- Marsh, S., J.W. Moran, S. Nakui, and G. Hoffherr. 1991. *Facilitating and Training in Quality function Deployment*. Methuen, MA: GOAL/QPC.
- Mazur, Glenn. 1993. QFD for Service Industries: From Voice of Customer to Task Deployment. In *Transactions from the Fifth Symposium on Quality Function Deployment*, Ann Arbor, MI:QFD Institute. ISBN1-889477-05-2
- Mazur, Glenn. 1994. *Initiating Service QFD*. Ann Arbor, MI: Japan Business Consultants, Ltd.
- Mazur, Glenn. 1995a. *Comprehensive QFD v5.0*. Ann Arbor, MI: Japan Business Consultants, Ltd.
- Mazur, Glenn. 1995b. Elicit Service Customer Needs Using Software Engineering Tools. In *Transactions of the Seventh Symposium on Quality Function Deployment*. Ann Arbor, MI: QFD Institute. ISBN1-889477-07-9

Sixth Annual Service Quality Conference

Mazur, Glenn. 1996. *Comprehensive QFD for Service Organizations v5.0*. Ann Arbor, MI: Japan Business Consultants, Ltd.

Mazur, Glenn. 1997a. Task Deployment: The Human Side of QFD. In *Transactions from the Ninth Symposium on Quality Function Deployment*, Ann Arbor, MI: QFD Institute. ISBN1-889477-09-5

Mazur, Glenn. 1997b. Voice of Customer Analysis: A Modern System of Front-End QFD Tools with Case Studies. AQC 1997. Milwaukee, WI: American Society of Quality Control.

Mazur, Glenn and Richard Zultner. 1996. Voice of Customer Tutorial. In *Tutorials of the Eighth Symposium on Quality Function Deployment*. Ann Arbor, MI: QFD Institute. ISBN1-889477-08-7

McQuarrie, Edward F. 1993. *Customer Visits: Building a Better Market Focus*. Newbury Park, CA: Sage Publications.

Mizuno, Shigeru, ed. 1988. *Management for Quality Improvement: The 7 New QC Tools*. Cambridge, MA: Productivity Press.

Mizuno, Shigeru and Yoji Akao, ed. 1994. *Quality Function Deployment: The Customer-Driven Approach to Quality Planning and Deployment*. Tokyo: Asian Productivity Organization.

Nayatani, Yoshinobu, Toru Eiga, Ryoji Futami, and Hiroyuki Miyagawa. 1994. *The Seven New QC Tools: Practical Applications for Managers*. Tokyo: 3A Corporation.

Nelson, Dale. 1992. The Customer Process Table: Hearing Customers' Voices Even If They're Not Talking. In *Transactions of the Fourth Symposium on Quality Function Deployment*. Ann Arbor, MI: QFD Institute.

Ohfuji, Tadashi, Michiteru Ono, and Yoji Akao. 1990. *Quality Deployment Methods: Procedures and Practices for Making Quality Charts*. Tokyo: Union of Japanese Scientists and Engineers (in Japanese).

Parquette, William. 1997. "Keep the 'second' CSI in mind while dealing with customers." *Automotive News*. July 7, 1997.

Pouliot, Fred. 1992. Capturing the Voice of the Customer. In *Proceedings from the GOAL/QPC Ninth Annual Conference, Advanced QFD Session*. Methuen, MA: GOAL/QPC.

Saaty, Thomas L. 1990. *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*. rev. 2nd ed. Pittsburgh: RWS Publications.

Zultner, Richard E. 1993. The AHP in QFD: Priorities That Fit Your Project. In *Transactions from the Fifth Symposium on Quality Function Deployment*, Ann Arbor, MI: QFD Institute. ISBN1-889477-05-2

Zultner, Richard E., 1992. Quality Function Deployment (QFD) for Software. In *Total Quality Management for Software*, edited by G.G. Shulmeyer and J.I. McManus. New York: Van Nostrand Reinhold.