Doubling Sales
with Quality Function Deployment

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Abstract

Three recent trends have lead to changes in the way travelers view airport food; (1) healthier and lighter food, (2) more women travelers, and (3) fewer on-board meals being served. Host Marriott, which operates 70% of the U.S. airport food and beverage market, wanted to assure that its product offerings were keeping up with customer demands. What they discovered was that their traditional approach to new product and service development was penny profit driven and not customer focused. QFD, the Japanese approach to new product development, was employed to make quality and customer satisfaction more important. What ensued startled us all: within two weeks sales were up 50%, and after one year sales had evened out at more than double their previous year's level.

Key words

QFD, Service Quality, Food Products, Bagels.

1.0 Company Profile of Host Marriott

Host opened in 1897 as a purveyor of food, beverage, news, and general merchandise in train stations, the leading form of mass land transportation at that time. They have continued to serve that market by now controlling over 70% of the food and beverage sales in U.S. airports and also operate food, beverage, and merchandise facilities in travel plazas on 12 east coast and midwestern highways. Host currently commands $1.2 billion in sales per year from its over 2,000 units in 170 locations worldwide. Over 40 different types of regional and international branded products, such as Burger King, Taco Bell, TGI Fridays, etc., make up 65% of this business.

Host's approach to developing new products and services has been primarily localized, with each operation identifying the needs of its market, sourcing new products, testing them, and keeping the ones that worked; a loose, vaguely defined process. The two driving forces behind this were 1) to get a product that fit the category at the lowest price tag in order to drive the penny profit and cost of sales margins and 2) how much free equipment the vendor would provide. Customer input was not normally sought

before or after that. Core items (coffee, hot dogs, baked goods, etc.) were secured through national contracts also driven by price and sales margins. Merchandising and delivery to customers were handled in the traditional way where Host determined what was to be done. Customer usage issues were not normally considered.

In 1994, Host began a strategic planning process to assess their strengths for the rest of the decade. Specific competitive opportunities were identified that exploited the competencies that had been built up over the last century. Several task forces were commissioned by Tom O'Hare, Vice President of Operations, to explore ways to improve product quality. Some of the task forces focused on core items like hot dogs, baked goods, deli, etc. They felt, however, that given their widespread activities and the importance of these new business directions, a more unified new product development process (NPD) was needed to assure that the quality of the output could be maintained from the strategic planning phase down through concept and delivery of the service across all locations.

2.0 Why QFD for New Service Planning and Development?

QFD is designed to improve customer satisfaction with the quality of our products and services. What can QFD do that is not already being done by traditional quality systems? To understand QFD, it is helpful to contrast the differences between modern and traditional quality systems.

2.1 Traditional Quality Systems

Traditional approaches to assuring quality often focus on work standards [Love 1986], automation to eliminate people, or 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 when 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 the top honors in the J.D. Powers Survey of New Car Quality, with Toyota Camrys built both in Japan and the US taking over the lead as the #1 vehicle in sales in North America in the first half of 1996.

2.2 Modern Quality Systems

QFD is quite different from traditional quality systems which aim at minimizing negative quality (such as poor service, broken product). With those systems, the best you can get is *nothing wrong* - which is not enough when other players in the market are also capable. In addition to eliminating poor service, we must also maximize positive quality (convenience, enjoyment, etc.). This creates **value**.

**Nothing Wrong
≠
Everything Right**

Quality Function Deployment (QFD) 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 and benchmark us against our competitors, and then direct us to optimize those aspects of our 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?

2.3 History of QFD

Quality Function Deployment began thirty years ago in Japan as a quality system focused on delivering products and services that satisfy customers. To efficiently deliver value to customers, it is necessary to listen to the "voice" of the customer throughout the product or service development process. The late Dr. Shigeru Mizuno, Dr. Yoji Akao, and other quality experts in Japan developed the tools and techniques of QFD and organized them into a comprehensive system to assure quality and customer satisfaction in new products and services [Mizuno and Akao 1994, Akao 1990].

In 1983, a number of leading North American firms discovered this powerful approach and have been using it with cross-functional teams and concurrent engineering to improve their products, as well as the design and development process itself [Akao 1983, Sullivan 1986, King, 1987]. Service organizations have also found QFD helpful. The author used QFD in 1985 to develop his Japanese translation business, **Japan Business Consultants**, and saw revenues increase 285% the first year, 150% the second year, and 215% the third year [Mazur 1993b]. QFD was an important part of **Florida Power & Light**'s successful bid to become the first non-Japanese Deming Prize recipient in 1990 [Webb 1990, Bodziony 1995]. It has been successfully applied in the U.S. healthcare industry since 1991 at **The University of Michigan Medical Center** [Gaucher et al 1991, Gaucher and Coffey 1993, Ehrlich 1993, Ehrlich and Hertz 1993, Ehrlich 1994], **Baptist Health System** [Gibson 1994, 1995], and other leading institutions. Interesting service applications also include the author's development of an engineering TQM curriculum at **The University of Michigan College of Engineering** [Mazur 1996] and the application to employee satisfaction and quality of work life at **AGT Telus** [Harries et al 1995]. Each year new applications are being reported in small businesses as well [Mazur 1993b, 1994a]. Since 1990, the author has consulted with other service organizations in distribution, education, food service, personnel, finance, healthcare, repair, retail, and transportation businesses.

Early applications of QFD in service organizations in Japan by Ohfuji, Noda, and Ogino in 1981 were for a shopping mall, a sports complex, and a variety retail store [Akao, 1990]. More recently, Kaneko has been integrating QFD, reliability, and quality circle activities in hotels, shopping centers, and hospitals [Kaneko 1990a, 1990b, 1991, 1992].

QFD has been heralded for such benefits as promoting cross-functional teams, improving internal communications between departments, and translating the customer's needs into the language of the organization.

2.4 Types of Requirements

To satisfy customers, we must understand how meeting their requirements affects 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.
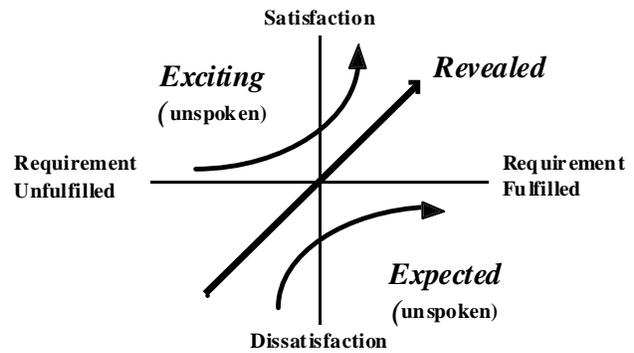

Figure 1. The Kano Model (adapted).
Service businesses must meet all three types of requirements - not just what the customer says.

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.

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 serve is critical to understanding their requirements.

Thus, eliminating problems handles 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 invisible to both the customer and the provider. Further, they change over time, technology, market segment, etc. The Japanese creators of QFD developed tools such as the Voice of Customer Tables [Akao 1990b, Ohfuji et al 1990, Nakui 1991, Marsh et al 1991, Mazur 1991a, 1991e, 1992c, 1993a, 1993b] and coupled them to affinity diagrams and hierarchy diagrams to break through this dilemna.

This process works best when the QFD team goes to *gemba (*where the customer interfaces with the service) to observe, listen, and record the problems customers experience and the opportunities they wish to seize. The customer voice tables provided a structure for recording the data. Going to the gemba can be difficult

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for those who are used to seeing things from an internal point of view. They tend to see more process problems and solutions than customer needs. QFD's systematic tools can help the NPD team see the world from the customer's point of view.

2.5 The Tools of Comprehensive Service QFD

While traditional quality tools were developed to handle quantitative data, a new set of tools were created to handle the more qualitative language and relationships often associated with nonmanufacturing activities [Mizuno 1988, Brassard 1989, Mazur 1992b]. The tools aid process reengineering for improving existing services, as well.

Matrix Data Analysis Charts are used to present the results of multivariate analysis of data. Particularly for customer segmentation, techniques such as conjoint analysis, cluster analysis, factor analysis, multiple regression analysis, and other techniques are useful when substantial quantitative customer data exists. This is the most mathematically sophisticated quality tool.

Affinity Diagrams are used to surface the "deep structure" in voiced customer requirements. This right-brained tool is generally produced by the *KJ Method*™ developed by cultural anthropologist Jiro Kawakita [Kawakita 1986]. Team members can directly elicit customers natural organization of requirements. Also, makes a good first step for creating hierarchy diagrams.

Relations Diagrams also called interrelationship digraphs can be used to discover priorities, root causes of service process problems, and unvoiced customer requirements.

Hierarchy Diagrams also called tree diagrams or systematic diagrams are found throughout all QFD deployments to check for missing data, to align levels of abstraction of the data, to diagram the why/how nature of functions, and to diagram failures.

Matrices and Tables are used to examine two or more dimensions in a deployment. Common types include relationships matrix, prioritization matrices, and responsibility matrices.

Process Decision Program Diagrams (PDPC) are used to analyze potential failures of new processes and services.

The Analytic Hierarchy Process (AHP) is used to prioritize a set of requirements and to select from among many alternatives to meet those requirements. This method employs pairwise comparisons on hierarchically organized elements to produce a very accurate set of priorities [Saaty 1990].

Blueprinting is a tool used to depict and analyze all the processes involved in providing a service [George and Gibson 1991]. A variant of the diagrams used in time/motion studies.

3.0 Customizing the QFD Road Map for Host Marriott

Although Host had previously experimented with the House of Quality, this was their first attempt at Comprehensive Service QFD [Mazur 1993a]. In order to thoroughly examine all facets for applicability beyond the current project, they elected to explore all the deployments in Comprehensive Service QFD. The standard deployments are explained in Table 1.

Deployment	Purpose
Customer Deployment	To define project success criteria and determine which customer segments and gembas are critical to success.
Voice of Customer Deployment	To understand the **true** needs of the customer through analysis of spoken and unspoken requirements and context of use.
Quality Deployment	Prioritization of customer needs and translation of them into service measures.
Function Deployment	To identify and prioritize required and new activities but without identifying how they are to be performed.
Reliability Deployment	To identify and preclude failpoints from a process.
New Process Deployment	To conceive and select alternative ways to perform the above functions.
Task Deployment	Detailed breakdown of the selected process to identify responsibility, equipment, and performance requirements.
Standardization	Job descriptions and standard operating procedures to hold the gains.

Table 1. The standard deployments of Comprehensive Service QFD.

3.1 Getting Executive Buy-in

The customization process began in March, 1995 with a one-day QFD overview presented to executives of both Marriott International and Host. Marriott attendees included Sam Bonfe, Director of Catering Standards MHRS, Jim Burns, Brand Executive, Jeff Brindle, Mary Scott, and Griff Lindsay from the New Business Team, and Helena Light-Hadley, Director of TQM MHRS. From Host came Jim Boragno, Sr. VP Products and Standards, Suzie Hill, Director of F&B Standards, Dick Knockerbocker, Director of Procurement, Bob Stanton, General Manager and OTL - Washington, D.C., Cindy Lynch, Food and Beverage Standards - St. Louis, and Ed Rudis, General Manager and OTL - Minneapolis. The meeting was hosted by the Vice President of TQM, Steve Lampa. Mazur was the subject matter expert.

The purpose of this meeting was to expose these executives to the methodology so that they could participate in determining whether QFD should be adopted as the standard new product and service design process. At this meeting, it was determined to do a pilot QFD project at the Phoenix Sky Harbor International Airport around improving baked goods products.

As a service, there are fewer large capital investments than in manufacturing companies, and it is possible to experiment in a "living lab" and make modifications relatively quickly. Mazur helped point out where QFD could be tailored to address these simpler business needs. Not everything in Host's core businesses need to be new and innovative products, so this limited trial helped them find an appropriate depth. The Phoenix team was lead by Wayne Eddy (Multi-unit Manager Terminal 3), with Terry Ell (General Manager), Pat Banducci (Controller), Michael Galvin (Multi-unit Manager Terminal 4), Joe Campbell (Commissary Manager), and Howard Rudin (Cluster Marketing Manager of Phoenix and San Diego). Lampa, the TQM VP asked Mazur to be the QFD instructor.

4.0 The Bagel Project Details

They did not want to take on all baked goods for the first project, and so the first job in QFD was to determine what would be best suited for product change. Thus began a three month journey in May, 1995.

4.1 Customer Deployment

Since QFD, like most TQM activities, tries to focus resources on the most important areas, it was useful to understand which customers they needed to satisfy most. The logic here was that if Host could meet or exceed the most important expectations of the most important customers, the rest would take care of itself. The generic model of customer deployment [Mazur 1993a] flows from identifying and prioritizing project success criteria to identifying and prioritizing core competencies to identifying and prioritizing customer segments. Since they were already dealing with strategic competencies, I helped them redefine the customer deployment to fit their situation. Figure 2 is a matrix flow chart of that process and figures 3 and 4 give a portion of the details. The purpose of these matrices was to determine key customers of key unit types (terminal, unit area, etc.), that would sell the targeted baked good, that would lead to the project being deemed successful by management. Once identified, they could target their market research on these customer segments first, thus conserving our research activities to the most fruitful segments.

Figure 2. Customer Deployment Matrices.
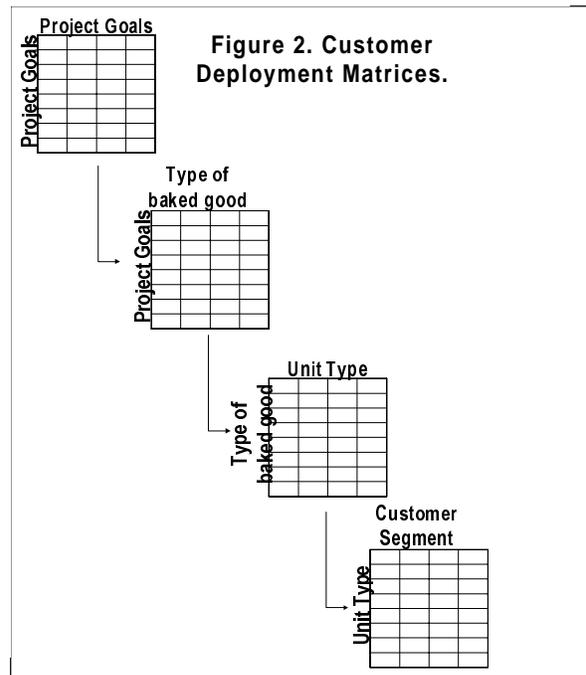
The first task was to clearly define how the project would be deemed successful by Host's management. First, the team brainstormed and then used a relationship diagram (details omitted) to understand the drivers and "resultors" of these goals. We found that customer satisfaction drove many of the other goals and should be the primary focus of the project. Increased sales, profit improvement, landlord satisfaction, associate satisfaction and 15 other goals were identified. With an affinity diagram, they were grouped under 5 headers: customer satisfaction, associate satisfaction, landlord (airport authority) satisfaction, profit, and won and retained sales contracts. Some goals were more important than others, and so a prioritization matrix was used to prioritize them. See Figure 3.

The next step was to augment the traditional baked goods with other potential varieties in order to identify the kinds of baked goods that might lead to customer satisfaction in an airport setting. Following my

Fig. 3. Prioritization of project goals.	CS	AS	LL	PI	WR	RAW SCORE	% OF TOTAL
CUSTOMER SATISFACTION (CS)	1	5	10	5	10	31.0	**40.5%**
ASSOCIATE SATISFACTION (AS)	0.2	1	5	5	10	21.2	**27.7%**
LANDLORD SATISFACTION (LL)	0.1	0.2	1	0.2	5	6.5	**8.5%**
PROFIT IMPROVEMENT (PI)	0.2	0.2	5	1	10	16.4	**21.4%**
WIN & RETAIN CONTRACTS (WR)	0.1	0.1	0.2	0.1	1	1.5	**2.0%**
TOTALS	1.60	6.50	21.20	11.30	36.00	76.60	100.0%

"batman" process of **b**rainstorm, **a**ffinity, **t**ree, **m**atrix, a hierarchy of possible baked goods was created. This assured that the team had not overlooked any baked goods that could have made an especially exciting offering. See Figure 4 for a portion of the tree.
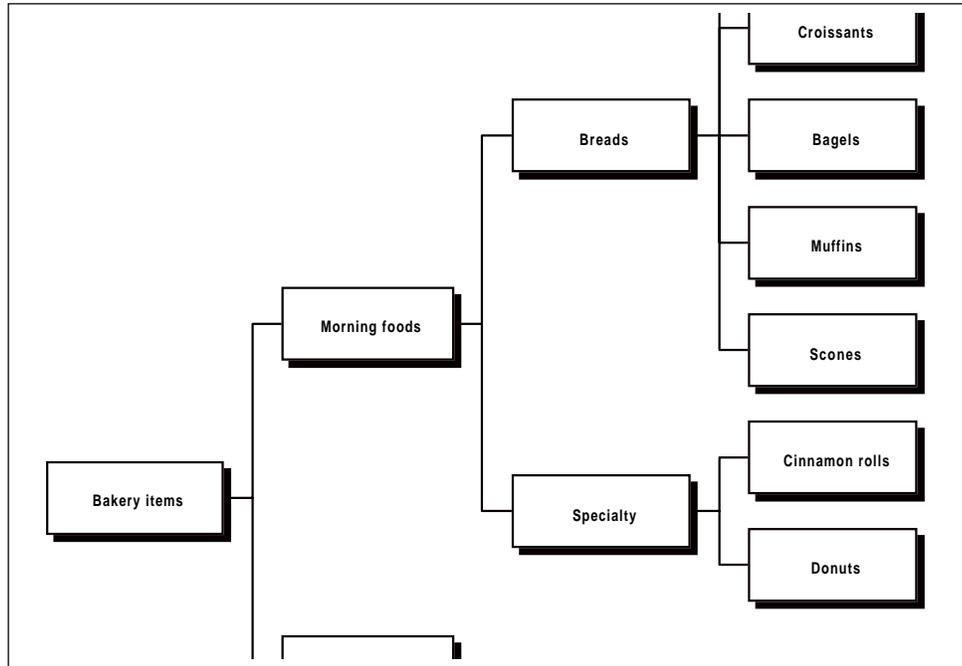
Figure 4. Tree of types of baked goods (partial)

The baked goods tree was prioritized in a matrix from the project goals and their priority weights (Figure 5). The analysis was to determine which baked goods would contribute most to the success of the project goals. From this, bagels were selected.

The next step was to determine the type of retail unit Host would sell these in. The batman technique was used to details these and a matrix was created with the highest priority baked goods and the type of unit (Figure 6). The unit types included full service restaurant, concourse kiosk with large display cases, ki-

Figure 5. Project Goals to Product Types Matrix

	Croissants	Bagels	Muffins	Danish	Priorities
Customer Satisfaction	○	◎	◎	△	40.5
Associate Satisfaction	△	◎	○	△	27.7
Landlord Satisfaction		△	△		8.5
Profit Improvement	△	◎	○	△	21.4
Win and Retain Contracts		△	△		2.0
Absolute Weights	170.6	814.9	522.3	89.6	
Product Type Weights	**10.7**	**51.0**	**33.0**	**5.6**	

osks with small display cases, and branded outlets. From this matrix we learned the type of sales unit which would be most successful at selling bagels - the concourse kiosk with large display cases.

The next phase was to identify customer types based upon use characteristics such as time of day, purpose of coming to airport, etc. This was a change from the usual market research that delivers demographic characteristics, such as income, education, etc. The batman process was applied to organize these into a matrix (Figure 7.) with the unit type based upon what type of customer was most likely to eat at a concourse kiosk. The highest priority customer segment turned out to be core business travelers with women traveling in the

Figure 6. Product Types to Retail Unit Type Matrix

	Full Service	Large Display	Small Display	Brands	Product Type Weights
Croissants	△	◎	◎	○	10.7
Bagels	△	◎	○	△	51.0
Muffins	△	◎	○	△	33.0
Danish	△	○	○		5.6
Priorities	5.0	49.0	34.2	11.1	

Figure 7. Unit Types to Customer Types (1st Level)

	Core Business	Meeters/ Greeters	Airport Workers	Unit Type Weights	
Full Service	△	△	△	5.7	
Large Display	◎	△	○	49.0	
Small Display	◎	△	○	34.2	
Brands	○	△	○	11.1	
Product Type Weights	67.0	8.5	24.5		

morning on business a surprisingly strong sub-segment. The team decided to look at both men and women. This is how they selected the gemba. The next step was to go to the gemba and determine the needs of these key customers.

In the traditional approach to going to the gemba in the context of product planning, attention was on internal issues such as sanitation, staffing levels, product display, etc., rather than on the customer using the products and facilities. I took them on a practice run down to the cafeteria, where the team spent about an hour observing customers enter (or choose not to enter) the cafeteria, look around for menus, inspect the food, take things, put things back, pay, and try to find a table. I taught them to look for and record were evidence that the customer was able to complete each action easily and pleasurably and to identify barriers. Especially valuable were smiles and grimaces on the faces of customers.

What they got was a view they don't normally see in their planning sessions in meeting rooms. Later, at the bagel gemba, there were many usage issues we had not seen before. For example, the packaged cream cheese was difficult to open, plastic utensils broke, there was no place to sit. Careful analysis of this data and interviews revealed that more bagel varieties and flavored cream cheeses were desired. We also noticed that they were selling bagels in a way that focused on speed of service (they wouldn't cut bagels or toast them which they thought could hold up the line), so they didn't offer the most popular ways bagels are eaten! As Steve Lampa of Host later exclaimed, "Our managers didn't believe customers really wanted a toasted bagel because they never asked for them. Boy, were we wrong!"

4.2 Voice of Customer Deployment

At the gemba, the spoken words and observed actions of the customer were recorded in the Voice of Customer Tables Part 1 and 2 (details omitted), which record usage data, such as time of day, whether meal or snack, etc. and sort the voices into benefits vs. features, respectively. The benefits, called demanded qualities in QFD, were put through the batman process, and included items such as "I have more choices," "Tastes good," "Easy to carry," etc.

A survey was conducted of bagel eaters at the gemba and about 50 responses were received. Demographics were about 40% men to 60% women, about evenly split between Phoenix residents and those who were not, and were about twice as many pleasure travelers as business travelers. They were asked to prioritize these benefits so that we would know which they valued the most. The survey also asked them to compare the current bagel offered at Host's airport terminals with those they had elsewhere in terms of each of the benefits. Frequency distributions of responses were incorporated into an analysis that showed us what was most important to customers and where competition was perceived as better. The mission then became to exceed the competition in those benefits which were most important to the customer. A portion of the survey is shown in Table 2.

Bagel Survey

We would like to ask you to complete a survey regarding the bagel you just purchased. Your input will help us make improvements and increase your satisfaction with the products we sell.

1. Please indicate by checking your choice of how important each bagel attribute is and where we rate in comparison to other bagels you have recently eaten.

vBagel Attribute	How Important is this Attribute to You as it relates to bagels and or bagel shop visits? PLEASE CHECK ONE BOX ONLY.					How do our bagels compare to others you have eaten? PLEASE CHECK ONE BOX ONLY.		
	Very Important	Important	Neutral	Unimportant	Very Unimportant	Better	Same	Worse
Tastes Good	41/74	12/22%	1/2%	0	1/2%	7/13%	27/51%	19/36%
Is visually appealing.	15/28%	26/48%	10/18%	1/2%	2/4%	3/6%	42/84%	5/10%
Bagel has a pleasant aroma.	15/28%	24/44%	13/24%	1/2%	1/2%	6/7%	35/69%	10/20%
Satisfies your appetite.	27/50%	22/40%	4/7%	0	1/2%	5/10%	40/78%	6/12%
Available to go		19/	7/	6/	1/	9/	38	3/

Table 2. Survey totals of customers' preferences and choices

4.3 Quality Deployment

The next phase was to translate the customer benefits into service measurements and performance targets that would help us design the new bagel service right the first time. QFD uses a special matrix called a House of Quality for this purpose. The House of Quality brings together on one sheet of paper the customer needs, preferences, and choice data from the market survey, the company's response to those needs in terms of service measures and performance targets, and yields a prioritized set of areas the company needs to address first.

Figure 8. Phoenix Bakery Project House of Quality

DEMANDED QUALITIES v. QUALITY ATTRIBUTES   (GRANDCHILDREN)

QUALITY ATTRIBUTES

DEMANDED QUALITIES	LIGHTING	SPACE/ DIMENSION	VISIBILITY OF OPTIONS	# OF BAGEL VARIETIES	SIZE	FLAVOR INTENSITY	AROMA	COLOR	SHAPE	# OF TOPPING VARIETIES	SPREADABILITY	PORTION SIZE	# OF HEATING OPTIONS	# OF CUTTING OPTIONS	# OF SERVG	IMPORTANCE	CURRENT	PLAN	IMPROVEMT	SALES POINT	ABSOLUTE	DEMANDED
I HAVE MORE CHOICES:																						
BAGELS	0	3	9	9	0	0	0	1	1	0	0	0	0	0	0	4.0	2.0	4.0	2.0	1.5	12	25
TOPPINGS	0	3	9	0	1	0	0	0	0	9	3	3	3	0	3	3.5	2.2	3.5	1.6	1.2	7	14
PREP. OPTIONS	0	0	0	0	3	0	0	0	1	1	3	1	9	9	9	4.0	2.2	5.0	2.3	1.0	9	19
SATISFIES MY APPETITE:																						
TASTES GOOD	1	0	3	3	0	9	9	3	0	9	1	1	3	0	0	5.0	2.7	5.0	1.9	1.0	9	19
VISUALLY APPEALING	9	9	9	9	3	0	0	9	9	9	3	3	1	3	3	4.0	3.0	4.0	1.3	1.0	5	11
PLEASANT AROMA	0	0	0	3	0	3	9	0	0	3	0	0	9	0	0	4.0	2.9	4.0	1.4	1.0	6	12
ABSOLUTE WEIGHT	120	217	509	418	104	209	278	183	144	453	152	114	386	204	246							
QUALITY ATTRIBUTE WEIGHT	3	6	14	11	3	6	7	5	4	12	4	3	10	5	7							
OUR CURRENT PERFORMANCE			15-20	2						3			1									
TARGET			50-60	4–6						4–5			2									
UNIT OF MEASUREMENT			% case space	# vari-eties						# vari-eties			# options									

Figure 9. Phoenix Bakery Project Function Deployment

QUALITY ATTRIBUTES V. FUNCTIONS

QUALITY ATTRIBUTES

FUNCTIONS

QUALITY ATTRIBUTES	COMM >>> SOURCE PRODUCT	ACQUIRE PRODUCT	STORE PRODUCT	PREPARE PRODUCT	SHIP PRODUCT	OPS >>> FINISH PREP	SELL PRODUCT	SERVICE CUSTOMER	DISPLAY PRODUCT	MAINTAIN PRODUCT	CLEAN ENVIRON.	Q.A. WEIGHTS
VISIBILITY OF OPTIONS	1	3	0	3	3	3	0	0	9	9	9	**14**
# OF BAGEL VARIETIES	9	9	3	9	9	1	3	0	9	9	0	**11**
# OF TOPPING VARIETIES	9	9	3	9	9	1	3	0	9	9	0	**12**
# OF HEATING OPTIONS	9	3	0	0	0	9	1	9	0	0	1	**10**
ABSOLUTE WEIGHT	315	280	69	249	249	159	79	94	333	333	136	
QA/FUNCTION WEIGHT	14	12	3	11	11	7	3	4	15	15	6	

Figure 10. Phoenix Bakery Project Function Deployment

DEMANDED QUALITIES v. FAILURE MODES   (CHILDREN)

FAILURE MODES >>>>>

DEMANDED QUALITIES	BAGEL'S BURNT	TOPPINGS FALL OFF	WRONG PORTIONS	FAILED QA STDS.	TOUGH BAGEL	RUN OUT OF SERVICEWARE	RUN OUT OF CONDIMENTS	RUN OUT OF PRODUCT	MESSY ENVIRONMT	EQUIPMNT FAILS	RUN OUT OF CLEANG SUPL	IGNORES CUSTOMERS	BAD HYGNE/ DRESS	DEMANDED QUALITY WT.
I HAVE MORE CHOICES:														
BAGELS	0	0	0	3	3	0	3	9	0	1	0	3	1	**25**
TOPPINGS	0	3	3	3	0	3	9	9	9	9	1	3	1	**14**
PREP. OPTIONS	9	3	1	9	3	3	3	9	3	9	1	3	1	**19**
SATISFIES MY APPETITE:														
TASTES GOOD	9	1	1	9	9	1	9	9	1	1	0	0	0	**19**
VISUALLY APPEALING	9	9	3	1	0	0	3	9	9	0	1	1	9	**11**
PLEASANT AROMA	9	0	0	1	0	0	1	9	3	1	0	0	9	**12**
ABSOLUTE WEIGHT	549	217	113	482	303	118	474	900	337	353	44	185	265	**100**
FAILPOINT WEIGHT	13	5	3	11	7	3	11	21	8	8	1	4	6	

What	Who	When	Where	How	How much	Why	Other
cutting ba-gels	Mike Galvin T-4 associate	by Aug, 28, 1995	in house	test equip-ment	until comfortable, but no less than 12 bagels	specs for cut-ting method	failure modes safety speed of service is-sues
order bagel cutter	Joe Campbell	by Aug. 25	in house	purchase or-der	at least 3 for each testing unit plus one backup	for start of project in unit	failure modes proper knife knife length
scoops for topping por-tioning	Joe Campbell	by Aug. 25	in house	test order	6 of each for each test unit	different types of top-pings, por-tion control, speed of service	possible equipment other than scoop, break-age

Table 3. Excerpt from task deployment table for Phoenix bakery project.

To save time, the House of Quality was approached at two levels. First was just the general categories of customer benefits or demanded qualities, and then from that was extracted a second House detailing only the most important areas from the first House. Figure 8 shows the latter of these.

The top four performance measures were selected for improvement efforts; the rest were to be main-tained at the current level of performance. These four were giving 50-60% of a display case to bagels, increasing the number of bagel varieties from two to six, increasing the number of topping varieties from three to five, and adding a toaster option to heat the bagels at time of serving.

4.4 Function Deployment

Once the performance targets were specified, it was necessary to determine what activities would be af-fected and who would be responsible for maintaining these performance levels. In Comprehensive Serv-ice QFD, these are identified through function deployment. Again, a two step approach, first a general matrix then a specific one was generated to identify the business functions that would be necessary to implement the changes. The matrix deployed the quality attributes and their priority weights from the bottom of the House of Quality to prioritize the most critical business functions for assuring success of the new bagel service. It showed that the commissary, sourcing, acquiring, and shipping of the new products would be critical. At the operations level, displaying and maintaining the attractive appearance of the bagels was identified as critical. See Figure 9. The sourcing people began right away contacting the big bagel vendors and cream cheese producers to learn what the current favorites were. I introduced Host to an industrial toaster company, Prince Castle, that had a toaster that could toast the bagel in about the same time as it takes to complete the sale, so there would be no delay of the airline passenger. Since both companies were engaged in QFD, it made it easier to discuss specifications in terms of customer needs.

4.5 Reliability Deployment

When developing a new service, it is important to assure that any new processes employed are not fail-ure prone prior to the new service starting up. Comprehensive QFD uses reliability deployment to first identify the potential fail points, and then to eliminate them in the design of the service. Figure 10 is the

reliability matrix. The failpoints are prioritized by deploying the demanded qualities from the House of Quality into the reliability matrix. The highest ranking failpoint in this matrix is running out of product and care was taken in any new process concepts to pay attention to inventory and reordering procedures.

4.6 New Concept Deployment

At this point in the QFD study, we now understood customer preferences and choices, performance targets, key business functions, and potential failures to avoid. This gave Host the information to begin developing alternative processes to fulfilling these requirements.

Different display cases, heating equipment, sourcing of bagels and cream cheese were worked into process flows and examined for their ability to meet the key customer, performance, functional, and reliability requirements identified in the above matrices. From Prince Castle, the Excalibur conveyor toaster was selected for its speed and safety. Several bagel sourcing options were considered including having bagels delivered by a local bakery twice a day, baking them at the commissary and delivering them to the concourse kiosks on a pre-set or on a per request basis, and baking them on site. New cutting devices were also explored.

After analyzing the alternative concepts, a par-baked and frozen bagel supplied by Uptown Bagels that can be thawed quickly and baked in the kiosk in six minutes and would allow fresh baked bagels produced to business demands was selected. A mandatory selection of plain, onion, cinnamon raisin, and honey wheat were chosen along with an optional blueberry and flavor of the month. Different cream cheese options were also explored. The selected process called for mixing flavors into a cream cheese that is whipped and blended on premise and then pre-packaged. Mandatory flavors are plain, onion/chive, and garden vegetable with options of strawberry, low fat, and a flavor of the month. Appropriate signage was also developed.

4.7 Task Deployment

The best laid plans come to fruition when individuals are made responsible for carrying out specific tasks in a manner that achieves the targets that were designed and planned in the previous steps. This is what task deployment does. I developed this deployment from the process quality control sheets commonly found in manufacturing. The purpose of task deployment is to assign for each step in the newly developed process, the person responsible, timing, location, equipment, skill or training, performance, and self inspection requirements. When these are met, then the new process is *assured* that it can meet all the requirements specified, and can thus meet the most important customer benefits, which will lead to achieving the goals of the project as defined at the beginning of the QFD. An excerpt of the task deployment tables is given in Table 3.

4.8 Standardization

No project is complete until we can assure the ongoing performance of the new system. Since QFD is a Total Quality Management approach, standards should be created for initial and ongoing training of employees and associates, vendor compliance, etc. After the tests were completed in August, the QFD team began to develop standards that have been compiled in a booklet entitled *Sales Double: QFD Bagel Project - A QFD Approach.* Published by Host Marriott Services at Phoenix, Arizona, this shows the specifications, procedures, policies, equipment, and expected results of this new service. This standard has

been adopted by Host's Food and Beverage standards department as the standard for all their generic (non-branded) units that sell bagels. Excerpts are given in Figure 11.

5.0 Sales Results

As the title implies, sales in the Phoenix airport concourse kiosks more than doubled as a result of the QFD efforts. Table 4 shows some of the results.

Location	Avg. Daily sales	Sales 30 days	Sales 120 days	% change
	***	***	***	
Terminal 3 Main Snack Bar	***	***	***	

Table 4. Selected results of Phoenix bagel project.

Changes in customer choice data were also tracked. Figure 12 shows for some of the most critical customer benefits how the new product was perceived compared to other bagels customers have had. As shown there were dramatic improvements in the key customer benefits of more bagel and cream cheese variety and heating options, as well as other benefits such as tastes good and easy to spread. And we were pleased that the enhanced options actually yielded improvements in service speed, which was contrary to what Host initially worried would deteriorate.

6.0 Conclusions

The benefits of QFD were certainly realized in this project. That they were able to achieve two to three times sales growth in only one month and then sustain that over the next six months speaks to the staying power of focusing on the customer and then standardizing the resulting improvements. Through this careful analysis, job responsibilities have been improved and those who are responsible for the day-to-day operations are involved in the process.

The next step is to carry this to the San Francisco operations, and to build this process into other future operations (see next section). The time commitment concerned them in terms of a cost-benefit ratio. By

the end of the project, six people had spent fifty-three hours each (a total of 318 hours) on this QFD project. Three issues emerge that affected this.

1. The team was new to QFD and many of its tools. In the future, the 7 Management and Planning tools should be taught first.
2. Host wanted to explore the full power of Comprehensive Service QFD in order to judge its applicability to future projects. Thus, some of the steps we took were more for learning purposes.
3. Host wanted to involve the corporate TQM department and so the project was stretched out over three months.

Now that they are educated in the process, Host intends to review the process steps in order to develop a "down and dirty" approach that can be done by a team dedicating their time off-line, rather than trying to fit it into their regular day.

I have recommended Blitz QFD, a matrix-less approach developed by Mark McDonald of Andersen Consulting and Richard Zultner of ZULTNER & CO. [Zultner 1995, 1996] for software QFD and myself for service QFD. It is quick enough that it can be done in a single day, if the team members have assembled the correct data in advance.

In the end, the plan is to develop a standard approach that must be followed in order to change the product specifications of Host's core products.

6.1 Future Activities: Halo Effect

The benefit of going to the gemba to understand the customer's perspective is being integrated into Host's planning process at Phoenix Sky Harbor International Airport. Two new projects have been engaged since January, 1996. One was the design of a new sandwich deli. Strong customer demands such as "sandwich is made the way I like it," "sandwich is fresh" and "sandwich is fast," have been realized with a moving sandwich line where the sandwich is moved from station to station by the attendants who add ingredients chosen by the customer. This has reduced a line back up as well as increased satisfaction by being able to choose what they get. Also, to make it easier for both the attendants to load bottled drinks in the refrigerator and for customers to remove them, the sliding door refrigerator has been replaced by one with an air curtain similar to units in a supermarket. Drink sales jumped almost immediately, and this is now becoming a standard configuration at other Host airport properties in the Southwest.

7.0 Acknowledgments

QFD is a cross-functional process that enlists the help of many people. I would like to thank foremost, Wayne Eddy and his team at the Phoenix Sky Harbor International Airport for their dedicated work on this project. It was by them and for them that this project succeeded. I would also like to thank Steve Lampa and the other executives at Host Marriott who took their time to study this process. The bagel, cream cheese, and toaster vendors also deserve acknowledgment for sharing their data and for helping with   testing   of   new   configurations.
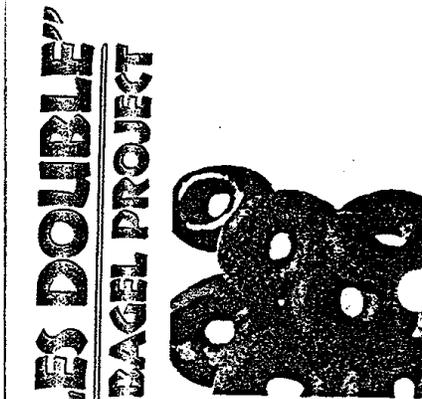
SERVICE PROCEDURES

Service Procedures:

- Greet Customer
- Ask " how may I help you "
- If type of bagel not chosen, offer assistance
- Use deli
- Ask, "
- Place slic
- If specific Ask at th
- Offer add
- Place crea with crea
- Place bag
- Finish tra
- Thank C
- FOOT NOTE: bagel toasted time, This all Without Stovel)

DISPLAY SPECIFICATIONS

Display:

- Bagel requirement is at least 50% of display case or bakery sales area
- Bagels must maintain a level of no less than 8 of each type during "selling period.
- Bagels may be stored on trays, in baskets or in a small coun
- Cream chee containers display area
- Cream chee of under 40
- Bagels and f to consume

BAGEL AND CREAM CHEESE SHELF LIFE

Bagel shelf life:

- Freezer : 6 month's
- Refrigerator (un-finished bake), 1 day's
- * Finished bake : - I flour is open air
  - 4 flours is a dry display case
  - 6 flours in a Small display holder with a hinge lid and limited air.
  - 8 flours wrapped in plastic bag

Cream Cheeses

- Stored in
- Stored in

* FOOT NOT

* FOOT NOTE: N bagels for a ful If at any time y it is imperative

BAGEL ORDERING

Bagel Ordering:

- Bagels may be ordered by the case if unit has freezer storage capacity
- Bagels may through yo
- Bagel is fr
- Your on-h increased t
- Order U

BAGEL SPECIFICATIONS

Bagel Type: Uptown Bagels

- Bagel is par - baked and frozen
- Bagel Thaws quickly and oven ready
- Bagel takes 6 minutes to finish in oven
- Bagel is HOT
- Bagel allows y
- Bagel has a co
- Bagel is cost ef

Bagel Assortment: Minim

- Mandatory: Pl and Honey Wl
- Additional: Bl

TABLE OF CONTENTS

"SALES DOUBLE"
QFD BAGEL PROJECT

Fig. 11   Excerpts from Phoenix Bakery Bagel Project Standards Manual.

SERVED IN A FAST MANNER

TASTE GOOD

TOPPINGS EASY TO SPREAD

WIDE VARIETY OF BAGELS
TO CHOOSE FROM

WIDE VARIETY OF TOPPINGS

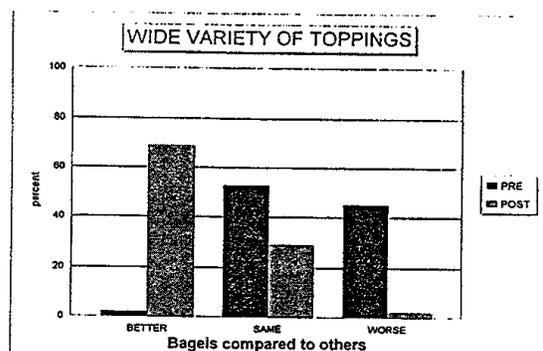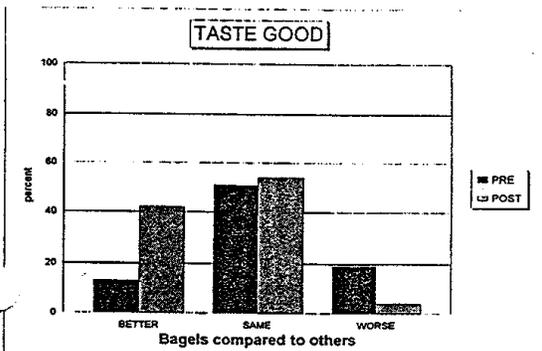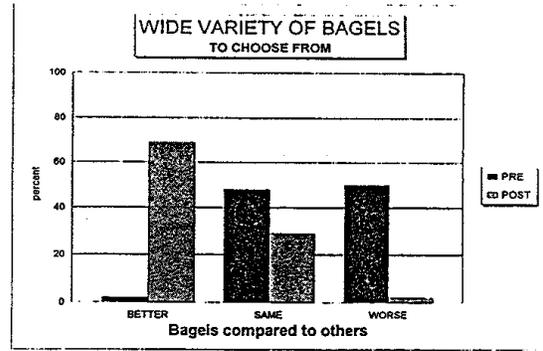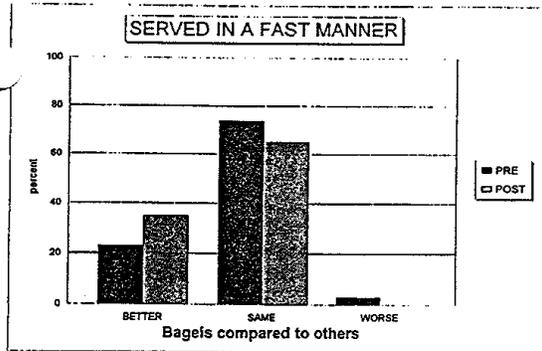AN ARRAY OF PREP CHOICES
(I.E., TOASTED)
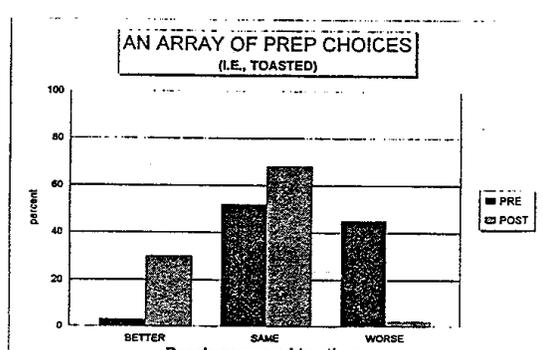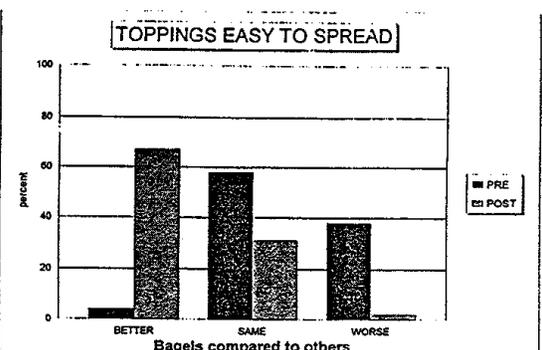
Fig. 12 Improvements in customer benefits.

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8.0 References

Akao, Yoji, ed. 1991. *Hoshin Kanri: Policy Deployment for Successful TQM.* Translated by Glenn Mazur. Cambridge, MA: Productivity Press. ISBN 0-915299-57-7

Akao, Yoji, ed. 1990. *Quality Function Deployment: Integrating Customer Requirements into Product Design.* Translated by Glenn Mazur. Cambridge, MA: Productivity Press. ISBN 0-915299-41-0

Akao, Yoji, ed. 1990b. *Introduction to Quality Deployment.* (In Japanese) Tokyo, Japan: JUSE. ISBN 4-8171-0257-8

Akao, Yoji. 1983. *Company-Wide QC and Quality Deployment.* Chicago, IL: The Cambridge Corporation.

Baluja, Sanju, Brian Elliott, Eric Endsley, Jim Kaounas, Robert Lepler, Elizabeth Lewis. 1995. *Shalimar, Haute Cuisine of India: Total Quality Management Guide.* University of Michigan.

Bodziony, Bob. 1995. "QFD and Deming Prize Activities at FPL." *Transactions from the Seventh Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute. ISBN1-889477-07-9

Brassard, Michael. 1989. *The Memory Jogger Plus.* Methuen, MA: GOAL/QPC. ISBN 1-879364-02-6

Brown, S.W., E. Gummesson, B. Edvardsson, and B. Gustavsson. 1991. *Service Quality: Multidisciplinary and Multinational Perspectives.* Lexington, MA: Lexington Books. ISBN 0-669-21152-4

Ehrlich, Deborah. 1994. "Health Care: Tailoring a Service Industry." *Transactions from the Fourth Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute ISBN1-889477-04-4

Ehrlich, Deborah. 1993. "Quality Function Deployment for Service Industries: A Case Study at the University of Michigan Medical Center." *Transactions from Performance Measurement Track, 6th Annual National Forum on Health Care Quality.* Oakbrook Terrace, IL: Joint Commission on Accreditation of Healthcare Organizations.

Ehrlich, Deborah and Dennis Hertz. 1993. "Applying QFD to Health Care Services: A Case Study at the University of Michigan Medical Center." *Transactions from the Fifth Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute. ISBN1-889477-05-2

Gaucher, Ellen J. and Richard J. Coffey. 1993. *Total Quality in Healthcare: From Theory to Practice*. San Francisco: Jossey-Bass Publishers.

Gaucher, Ellen, T. Daly, J. Walker, and V. Walter. 1991. "Quality Function Deployment Process: Experiences in an Ambulatory Care Service." *Proceedings from the GOAL/QPC Eighth Annual Confere*nce. Boston, MA: GOAL/QPC.

George, William R. and Barbara E. Gibson. 1991. "Blueprinting: A Tool for Managing Quality in Service." Brown, S.W., E. Gummesson, B. Edvardsson, and B. Gustavsson. 1991. *Service Quality: Multidisciplinary and Multinational Perspectives.* Lexington, MA: Lexington Books. pp. 73-91. ISBN 0-669-21152-4

Gibson, Jeff. 1995. "Happy Feet Part II: Return of the Princeton Foot Clinic." *Transactions from the Seventh Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute. ISBN1-889477-07-9

Gibson, Jeff. 1994. "Health Care Services: Princeton Foot Clinic." *Transactions from the Fourth Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute. ISBN1-889477-04-4

Harries, Bruce and Matthew Baerveldt. 1995. "QFD for Quality of Work Life." *Transactions from the Seventh Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute. ISBN1-889477-07-9

Kaneko, Noriharu. 1992. "QFD Applied in a Restaurant and Hotel Chain." *Transactions of the 1st European Conference on Quality Function Deployment.* Milan, Italy.

Kaneko, Noriharu. 1991. (In Japanese) "Using QFD in a Service Industry." *Transactions of the First (Japanese) Symposium on Quality Function Deployment.* Tokyo, Japan: JUSE.

Kaneko, Noriharu. 1990a "Quality Assurance in Service Industries." *ASQC Congress Transactions.* San Francisco, CA: American Society for Quality Control.

Kaneko, Noriharu. 1990b. "QFD at a Supermarket." *Case Studies.* Austin, TX: Kaizen Institute of America 3-day Public Seminar.

Kano, Noriaki, Nobuhiko Seraku, Fumio Takahashi, and Shinichi Tsuji. 1984. "Attractive Quality and Must-Be Quality." Translated by Glenn Mazur. *Hinshitsu* 14, no. 2. (February): 39-48. Tokyo: Japan Society for Quality Control.

Kawakita, Jiro. 1986. (In Japanese) *The KJ Method: Seeking Order Out of Chaos.* Tokyo: Chuokoron-sha. ISBN 4-12-001517-3

King, Bob. 1987, 1989. *Better Designs in Half the Time: Implementing QFD Quality Function Deployment in America.* Methuen, MA: GOAL/QPC.

Lampa, Steve and Glenn Mazur. 1996. "Bagel Sales Double at Host Marriott Using Quality Function Deployment." *Transactions from the Eighth Symposium on Quality Function Deployment*, Ann Arbor, MI:QFD Institute, June, 1996. ISBN1-889477-08-7

Love, John F. 1986. *McDonald's: Behind the Arches.* Toronto: Bantam Books. ISBN 0-553-05127-X

Marsh, S., J.W. Moran, S. Nakui, and G. Hoffherr. 1991. *Facilitating and Training in Quality function Deployment.* Methuen, MA: GOAL/QPC. ISBN 1-879364-18-2

Mazur, Glenn. 1996. "The Application of Quality Function Deployment (QFD) to Design a Course in Total Quality Management (TQM) at The University of Michigan College of Engineering." *Proceedings of International Conference on Quality - 1996 Yokohama.* JUSE. October 15-18, 1996.

Mazur, Glenn. 1994a. "QFD for Small Business: A Shortcut through the 'Maze of Matrices'," *Transactions from the Sixth Symposium on Quality Function Deployment*, Ann Arbor, MI:QFD Institute, June, 1993. ISBN1-889477-06-0

Mazur, Glenn. 1993a. *Comprehensive Service Quality Function Deployment.* Ann Arbor, MI: Japan Business Consultants, Ltd.

Mazur, Glenn. 1993b. "QFD for Service Industries: From Voice of Customer to Task Deployment," *Transactions from the Fifth Symposium on Quality Function Deployment*, Ann Arbor, MI:QFD Institute, June, 1993. ISBN1-889477-05-2

Mazur, Glenn. 1992a. "Task Deployment for Service QFD and the Americans With Disabilities Act," *Proceedings from the GOAL/QPC Ninth Annual Conference*, Boston, MA.

Mazur, Glenn. 1992b. "The Seven Management and Planning Tools and QFD," *Annual Review of Communications,* National Engineering Consortium, Vol. 46, 1992-93, pp. 804-811.

Mazur, Glenn. 1992c. "Voice of the Customer Table," *Transactions from the Fourth Symposium on Quality Function Deployment*, Ann Arbor, MI:QFD Institute. ISBN1-889477-04-4

Mazur, Glenn. 1992d. *Basics of Quality Function Deployment.* Ann Arbor, MI: Japan Business Consultants, Ltd.

Mazur, Glenn. 1991a. "Voice of Customer Analysis," *Proceedings from the GOAL/QPC Eighth Annual Conference*, Boston.

Mazur, Glenn. 1991b. "Sensory QFD: Matching Product Image to Customer Image Using *Kansei* Engineering," *Proceedings from the GOAL/QPC Eight Annual Conference*, Boston, MA.

Mazur, Glenn. 1991c. "Quality Function Deployment: Should You Really Function Without It?" *The Quality Management Forum,* ASQC, Vol. 17, no. 3.

Mazur, Glenn. 1991d. "QFD - The House of Quality: Practicing What We Preach," *OMNEX News,* Ann Arbor, MI, Fall, 1991.

Mazur, Glenn. 1991d. "Getting Started with Quality Function Deployment," *OMNEX News,* Ann Arbor, MI, Summer, 1991.

Mazur, Glenn. 1991e. "Voice of the Customer Analysis and Other Recent QFD Technology," *Transactions from the Third Symposium on Quality Function Deployment*, Ann Arbor, MI:QFD Institute, June, 1991. ISBN1-889477-03-6

Mizuno, Shigeru and Yoji Akao, ed. 1994. *Quality Function Deployment: The Customer-Driven Approach to Quality Planning and Deployment.* Translated by Glenn Mazur. Tokyo:Asian Productivity Organization. ISBN 92-833-1122-1

Mizuno, Shigeru, ed. 1988. *Management for Quality Improvement: The 7 New QC Tools.* Cambridge, MA: Productivity Press. ISBN 0-915299-29-1

Nagamachi, Mitsuo. 1993. *The Art of Kansei Products.* (in Japanese) Tokyo:Kaibundo. ISBN 4-303- 72820-9

Nagamachi, Mitsuo. 1992. "*Kansei* Engineering and its Methods." (in Japanese) *Keiei Systems.* Vol. 2 No. 2.

Nagamachi, Mitsuo. 1989a. "QC Activities for Service Industries: *Kansei* Quality Control." (in Japanese) *Engineers,* 11/89 Tokyo.

Nagamachi, Mitsuo. 1989b. *Kansei Engineering.* (in Japanese) Tokyo:Kaibundo. ISBN 4-303-71320-1

Nakui, Satoshi. 1991. "Comprehensive QFD System." *Transactions from the Third Symposium on Quality Function Deployment.* Ann Arbor, MI:QFD Institute. ISBN1-889477-03-6

Nakui, Satoshi and Yoji Akao. 1990a. "Determining Demanded Quality Through Questionnaires." Tone, K. and R. Manabe, ed. (In Japanese) *Case Studies in AHP.* Tokyo: JUSE Press. pp. 136-145. ISBN 4-8171-5016-5

Nakui, Satoshi and Yoji Akao. 1990b. "Function Deployment Applied to Manufactured Housing." Tone, K. and R. Manabe, ed. (In Japanese) *Case Studies in AHP.* Tokyo: JUSE Press. pp. 145-159. ISBN 4-8171-5016-5

Ohfuji, Tadashi, Michiteru Ono, and Yoji Akao. 1994 (in Japanese) *Quality Deployment Methods (2): Comprehnsive Deployment for New Technology, Reliability, and Cost.* Tokyo: Union of Japanese Scientists and Engineers. ISBN 4-8171-0259-4

Ohfuji, Tadashi, Michiteru Ono, and Yoji Akao. 1990. (in Japanese) *Quality Deployment Methods: Procedures and Practices for Making Quality Charts.* Tokyo: Union of Japanese Scientists and Engineers. ISBN 4-8171-0258-6

Porter, Michael E. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance.* New York: The Free Press. ISBN 0-02-925090-0

Saaty, Thomas L. 1990. *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World.* rev. 2nd ed. Pittsburg:RWS Publications. ISBN 0-9620317-0-4

Takasu, Hisashi. 1994. "QFD for Demanded Services: A Restaurant Case" *Standardization and Quality Control.* (in Japanese) Tokyo: Japan Standards Association. Vol. 47. Sept. 94. pp. 52-61.

Webb, Joseph L. and W. C. Hayes. 1990. "Quality Function Deployment at FPL." *Transactions from the Second Symposium on Quality Function Deployment*, *Ann Arbor, MI:QFD Institute.* ISBN1-889477-02-8

Zemke, Ron and Dick Schaaf. 1989. *The Service Edge: 101 Companies That Profit from Customer Care.* New York: Plume Books. ISBN 0-452-26493-6

Zultner, Richard E. 1996. "Blitz QFD Tutorial: A Streamlined Start toward Comprehensive QFD." *Tutorials from Eighth Symposium on Quality Function Deployment.* Ann Arbor, MI: QFD Institute, June 1996.

Zultner, Richard E. 1995. "Blitz QFD: Better, Faster, Cheaper Forms of QFD." *QFD Institute Forum Hardcopy 1995.* Ann Arbor, MI: QFD Institute. ISBN 1-889477-51-6.

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

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