Task Deployment:

The Human Side of QFD

Glenn H. Mazur

QFD Institute
Japan Business Consultants, Ltd.
University of Michigan College of Engineering

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Japan Business Consultants, Ltd. 1140 Morehead Ct. Ann Arbor, MI 48103 USA
+1 (313) 995-0847 Fax: +1 (313) 995-3810 E Mail: gmazur@engin.umich.edu

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Abstract

Who should read this paper? QFD facilitators, team leaders, project leaders, and QFD trainers.

What should this paper do for you? Determine the quality of activities engaged in by people, and set standards for responsibility, deadlines, reporting, facilities, quality, problem prevention, etc. Understand task priorities.

When should this paper be read? As a part of training, at the start of projects, during the project, and during new product development process reengineering.

Where should this paper be read? Where the above activities will take place.

Why is this paper important? Ultimately, the effectiveness of a new product design comes down to the people who do the work. This paper will explain how to maximize the quality of their work.

How will this paper explain things? This paper will discuss the history of Task Deployment, its structure based on the 5W2H3C1F formula plus flow charting, and give examples of applications in QFD for determining project teams, defining market segments based on product usage, guiding customer visits, analyzing customer's business problems, creating job descriptions and plant requirements for service operations, and redefining the New Product Development Process itself.

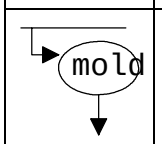
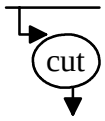
Key Words: Human Resources, Job Descriptions, Process, QFD, Task Deployment

Background of Task Deployment

Task deployment is fundamental to all TQM activities in that it creates the standard operating procedure (SOP) that assures through the development of standards, the ongoing quality and maintenance of improvements. In the manufacturing environment, quality standards, work flows, QC process charts, process control sheets, and other documents are commonly used to control the quality of the manufacturing process [Mizuno and Akao 1994, p. 78]. Common to these forms are the part name, name of step or process (with flow chart), operating instructions, person responsible for the process, inspection method, sampling frequency, instruments required, control items and target values, what to do in case of an anomaly, and other important data to plan the work flow and instruct the operator. See Table 1 [Mazur 1995a]. The rightmost column is of special interest. This was added by Daihen Corporation, winner of the 1987 Deming Prize, to better connect the equipment operators in the plant with the functionality, satisfaction, reliability, and safety impact from the customer's point of view.

These charts were brought to the design phase of QFD by Dr. Akao [Mizuno and Akao 1994, ch. 2] to assure the quality of the new processes that were being developed for new products, the goal being to get it right the first time in order to reduce start-up delays and waste. One of Dr. Mizuno's great contributions to QFD was his use of these charts to document the quality of staff efforts in all departments involved with assuring the quality of the new product. In other words, it was not enough to assure just operator activities on the plant floor with process standards, but it was helpful to assure the quality of marketing, sales, R&D, engineering,

Table 1. QC Process Chart [Mazur 1995]

[F] Part critical to function [S] Part critical to safety [R] Part critical to other regulation			Department Molding				Prepared by: TR Date: 3/9/92 Checked by: JR Date: 4/12/92 Approved by: NG Date: 4/14/92			Part No. (internal): 3345AZ3 Part No. (customer): Part Name: Reflector				
Process Flow	Process Point	Process Control				Step No.	Process Name (equip,	Control Item (Qual Char)	Spec. Value	Quality Confirmation				Reason for control
		Conditions	Frequency	Method	Std					Freq	Method	Chk by	Doc	
		Injection molder				1	Mold substrate	Shape Dimension	f55± .1 t=2mm	1/lot 1/lot	micrometer	opera-tor	x-R	Magnification
		Inj. press 30kg/cm^2	1/hour	Gage	IP 62		[F]	Finish	zz	1/hr	glossmeter	QC	ShtA 6	Reflective pwr
Mat'l: PVC P/N 54905														
		Thermal cutter 350°C	1/hour	thermom eter	T34	2	Remove flash	No flash	0	all	Visual	operator	Chk Sht	Ease of assembly

quality control, service, and other functional responsibilities as well.

The original work in this area was promoted by Dr. Mizuno who brought a Value Engineering foundation to QFD. His perspective was to improve the function of assuring quality by identifying which organizational functions were responsible for which activities.

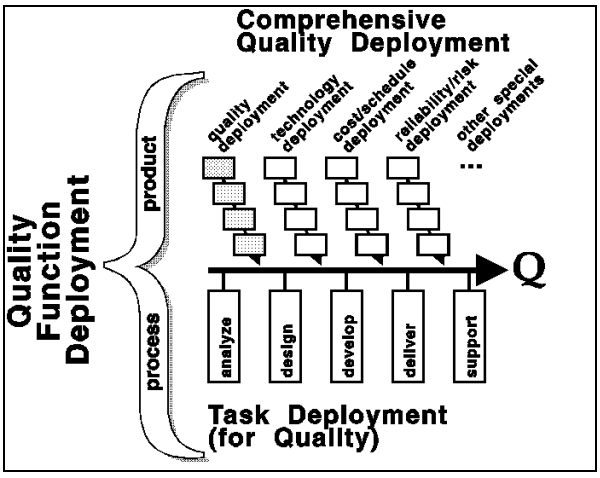


Figure 1. Comprehensive Quality Function

In Akao's original model for Comprehensive QFD (Figure 1), what we call the matrices make up only half the system, which are shown above the arrow. What Dr. Mizuno contributed with his value engineering background is shown below the arrow. Originally given the confusing name of quality function deployment narrowly defined, what was meant was a deployment of the quality function as had been defined by Dr. Armand Feigenbaum in 1961 as the activities to produce, supply, and use quality. In other words, this was the deployment of quality throughout the organizational activities. The quest for quality in the product itself was not included in Feigenbaum's approach, according to Mizuno and Akao. Thus, the formation of QFD was to take Feigenbaum's system (the process of product development) and add to it a focus on the product (using the matrices applied to the product itself) to achieve quality. Akao called this combination quality function deployment broadly defined. My experience with Japanese companies is that most of the major players do the process part of QFD even if they don't do the product part. This results in a permanent change and engineering of the new product development process that is hard to beat. I use the word engineering because most product development processes I've seen have been pieced together, not engineered, so how can you have "re-engineering" when it was never engineered in the first place!

Unfortunately, this part of QFD is not widely known in the West, and so many new product teams have difficulty in systematizing their product development process and extending their achievements to future products. Instead they see QFD as

a time consuming activity that must be done from scratch each time. My experience has been that project teams that improve their organizational process of product development find the matrices and associated product oriented activities a natural and necessary part of their daily work. I believe this is the intention of the creators of QFD, Drs. Mizuno and Akao. Step-by-step instructions on the process side of QFD can be found in Chapter 11 of *QFD: The Customer-Driven Approach to Quality Planning and Deployment* [Mizuno and Akao 1994], *Basic of Quality Function Deployment v 5.0* [Mazur 1995], and "A Road Map to a Better Product Design Process: Structuring a Quality Design Process Chart (QDPC)" [Nakui and Terninko 1992]. What is relevant here is how this process improvement can be more broadly applied to other human task endeavors found throughout the QFD product side, as well.

When Mr. Toshio Iwahashi of the Internal Combustion Division of Kubota developed the quality assurance activities table that outlined the required tasks to assure quality of design and manufacturing, he included, as well, as their "purpose," person responsible, standards, and documentation [Mizuno and Akao, 1994 pp. 265-274]. Essentially, he pulled the same type of information found in the QC Process Chart in Table 1 and applied it to the people processes in product development, in conformance with Dr. Mizuno's approach. This effectively set standards of performance, responsibility, quality measures, and documentation requirements for each people process. In 1993, I simplified the terminology using the who, what, when, where, why, how (5W1H) format and applied this to both the development process and the product process for service industries [Mazur 1993, 1996a]. Subsequently, I have expanded the basic format to include "how much" for measurements, and cost (any expenditure of resources such as time, people, money, information), control points (to measure results), check points (to measure causal inputs) and failure modes (mistakes and omissions). This paper will explain the basic format, its application in various QFD activities, and give examples.

Identifying Overlooked Activities with Task Deployment

The power of task deployment is in its ability to organize human activity around essential factors that should or should not be done. Another benefit is to identify when the tasks and processes are still being designed those activities that are often taken for granted and could be overlooked until too late, and to identify new activities that could bring real excitement and value to the job.

One of the fundamentals of Total Quality Management is the principle of "next process is your customer." This means that any task that uses the output of another task is a customer of that task. Modern TQM practitioners have expanded this to now include previous processes as well as peer processes. The principle has been updated to "everyone but you is your customer." In a QFD team, the team members themselves may also be considered customers, so let's rephrase this as "everyone including you is your customer." Using *this* definition of customer, those overlooked and new activities can be more easily conceived as "requirements" the task must fulfill.

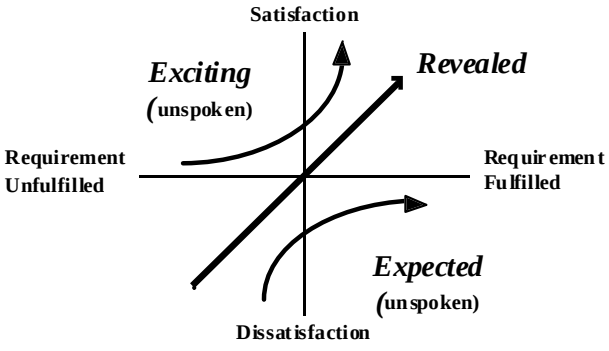


Figure 2. The Kano Model (adapted). Task designers should consider all three types of activities - not just what is currently being done.

Types of Requirements

To satisfy customers or tasks, we must understand how meeting their requirements effects satisfaction. There are three types of requirements to consider (see Figure 2) [Kano, *et. al.*, 1984].

Revealed Requirements are typically what we get just by asking customers what they want. These are usually activities that are currently being performed and are already in job descriptions. These requirements satisfy (or dissatisfy) in proportion to their degree of being performed. Completing a report on time would be a good example. The more (or less) complete the report, the more (or less) it is liked.

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 task may cease to be of value; their absence is *very* dissatisfying. Further, meeting these requirements often goes unnoticed by most customers. An example is errors and omissions in a report. 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 the report is distributed in an Adobe Acrobat® format along with a hard copy, users could easily excerpt portions to include in their own reports, thus saving time and the risk of inaccuracy. These are the things that wow the customer. Since customers are not apt to voice these requirements, it is the responsibility of the process owner to explore customer problems and opportunities to uncover such unspoken items.

Kano's model is also dynamic in that what might excite today becomes a standard and is expected in the future. In addition, things that are exciting to one process customer may be expected by another. Eliminating problems addresses expected requirements. There is little added value when nothing goes wrong. Conversely, great value can be gained by discovering and delivering an exciting requirement. Task deployment helps assure that expected requirements don't fall through the cracks and points out opportunities to build excitement into processes. To summarize Kano, the exciting needs, which are most tied to adding value, can be invisible to both the process 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, 1993] and coupled them to affinity diagrams and hierarchy diagrams to enhance this opportunity.

Plan-Do-Check-Act

The Plan-Do-Check-Act cycle of Dr. Shewhart is necessary from a quality point of view to examine for missing tasks. This cycle requires us to plan the process steps including their purpose and measurement systems, perform the tasks, check and study the results, and take corrective action. This means that the process must also include steps to check and act, i.e. feed forward and feedback loops. These are often overlooked as non-value added steps, but since their purpose is to prevent failure and get it right the first time, a quality approach should take care to include such steps. A purpose hierarchy (tree) diagram is used to elicit the tasks in PDCA order at various levels of detail. See Table 3.

Prioritizing Tasks

Are all tasks equally important to the process or the team? It can be beneficial to prioritize tasks so that the most attention or resources can be allocated to the most critical ones. But most critical based on what criteria? The team's opinion, the customer's needs, business needs?

Depending on the stage of QFD, different prioritization methods may be used. If we already have a higher level set of priorities, for example customer needs, functions, or processes, we can create a matrix with these in the rows and the tasks in the columns, and by examining the strength of the relationships between the rows and columns, distribute the relative priorities of the row values

Figure 3. Prioritization Matrix for Restaurant. [Mazur 1994b]

	Food preparation	Prepare	Cook	Convey	Serve	Clear	Wash	Importance	Us	Hotel S	Plan	Improvement ratio	Sales Point	Raw Score	Demanded Quality Wt.
Food is fresh		3	3	9				4	3	4	4	1.3	1.2	6.4	24.3
Local delicacies		3	9		1			1	3	4	4	1.3	1.2	1.6	6.1
Elaborate presentation		3	3	9	1			2	3	3	4	1.3	1.0	2.7	10.1
Tasty seasoning		9	9					2	3	3	3	1.0	1.0	2.0	7.6
Proper temperature		3	9	9				4	3	4	5	1.7	1.0	6.7	25.3
Polite service					9			3	4	4	4	1.0	1.0	3.0	11.4
Clean		3		3		1	9	3	3	3	4	1.3	1.0	4.0	15.2
Absolute Wt.		311	454	583	119	15	137								
Process Priority		19.2	28.0	36.0	7.3	0.9	8.4								

across the tasks in the columns [Mazur 1994a, b]. See Figure 3.

In other situations, there may not be a deployment of information or there may not be a prioritized set of data yet. Sometimes a more precise prioritization may be required, such as when allocating budget dollars or other constrained resources. Other times, it is difficult to assign numerical values of importance to tasks. The Analytic Hierarchy Process [Saaty 1990, Mazur 1996a] natural language comparisons (Task A is moderately more important than Task B) is used to yield precise ratio scale priorities and can even trap inconsistencies in human judgment. High priority tasks should be deployed with the Task Deployment Table.

The Task Deployment Table

The QC Process Chart in Table 1 uses manufacturing terminology that may be less familiar to the non-engineers on the QFD team or strange to those in service industries. For this reason, the 5W2H3C1F nomenclature explained in Table 2 may be preferred. This table is broad enough to cover a wide variety of situations, so not all the 5W2H3C1F are necessary all the time. Often the definitions of these terms must be adapted. Table 2 shows a common structure for all the terms. Other columns may be added if helpful.

Task Deployment Case Studies

In general, the Task Deployment Table breaks down each task into its essential steps, responsibilities, timing, location, methodology, equipment and facilities, measurement, standards, documentation, and potential failure modes. The following examples will show how the table can be customized to meet the purpose of the task.

Determining Project Teams

If the process side of QFD is performed in advance of or concurrent with the product side of QFD, it can be used to determine the project team. What is key is to determine what tasks are necessary to develop a quality product, and then use the Task Deployment Table to deploy the details. The documentation column has been added here and essentially defines which matrices to use in the

Table 2. General definitions of 5W2H3C1F.

5W2H3C1F	Current	New	Not	Examples
Who	is/ should be using or doing it?	else could/ should be using or doing it?	should not be using or doing it?	purchaser, consumer, installer, responsible person, roles, responsibilities, leadership
What	is/should be used or done?	else could be used or done?	should not be used or done?	task, process
When	is it/should it be used or done?	else could it be used or done?	should it not be used or done?	time of day, season, frequency, before or after some event, sequence, when people join the team
Where	is it/should it be used or done?	else could it be used or done?	should it not be used or done?	geographic location, extreme conditions
Why	is it/should it be used or done?	else could it be used or done?	should it not be used or done?	special needs, purpose, reason, goal, objective
How	is it/should it be used or done?	else could it be used or done?	should it not be used or done?	professional or amateur, procedures, methods, tools, information
How much	is/should be used or done?	else could be used or done?	should not be used or done?	quantity, degree, effort
(What) Cost	is/should be expended?	(What other) Costs could be expended?	should not be expended?	money, time, people, information, resources
(What) Control	measurements are/should be monitored?	other measurements could be monitored?	measurements should not be monitored?	measurements of results, managerial evaluations, inspections, process outputs, standards, documentation
(What) Check	measurements are/should be self-checked?	other measurements could be self-checked?	measurements should not be self-checked?	measurement of methods or activities over which the "doer" has control and can check himself, causal factors, process inputs, standards, documentation
(What) Failures	are occurring?	could occur?	should NEVER occur?	failure of desired outcome, total failures, discourtesies, frustrations, design failures

product side of QFD. See Table 3 [Mazur 1995a]. This table is frequently converted to a flow chart to aid scheduling of product development activities. Notice how the customer, in this case the consumer, has been added to the organization functions in the columns in order to indicate their role in requirements definition. See Figure 4 [Mazur 1993, 1995a, Nakui and Terninko 1992].

Defining Customer Segments Based upon Usage, Using the Task Deployment Table

Traditional market research activities often yield valuable data for testing customer preferences for different product concepts. Demographic data is also assembled to determine purchasing trends, advertising effectiveness, brand recognition, and other important factors about the market.

In product development, we frequently use QFD ahead of concept development in order to develop the concepts themselves. In these situations, it is necessary that the QFD team visit the customer where they actually would use the product or service. This placed is called the *gemba* in Japanese, and it is where we can observe the customer facing the problems and opportunities in their lives and businesses. Through this observation we are able to determine a variety of unanticipated uses and unvoiced requirements. This gives rise to unique product and service solutions for us to consider in later market testing and research.

But which customers, which *gembas*, should be focused on? How should they be defined? If the purpose of the visit is to observe the customer at work using the product or service, why not define the *gembas* in a way which will facilitate this observation? The Customer Segment Table can be constructed from the task deployment table to aid in identifying the most likely customer *gembas* to observe. See Table 4 [Mazur 1995a, 1997] Appropriate gembas can be identified by "chain linking" data across the columns based on known quantitative data, or even past experience [Daetz et al]. The AHP has also been found useful for prioritizing likely chains.

Conducting *Gemba* Visits

Phase	Purpose	Tasks	Who	When	How	Doc.
Check current market	To gain correct understanding of market requirements.	C: Survey market	* Marketing Sales	Quarterly	Survey cust & competitor	Quality Plan Table
		A: Analyze data	* Marketing Development	After survey	Mean/Mode distribution	"
		P: Identify benchmarks	* Develop Sales	2/year	Review trends	Matrix Data Analysis
		D: Evaluate competition	* Marketing Sales	2/year	Gap analysis	Quality Plan Table
Act to improve current service	To make immediate improvements	C: Evaluate current service	* Sales Development	Quarterly	Survey cust & competitor	Quality Plan Table
		A: Take corrective action	* Develop QIT	After survey	QIP	Story Board
		P: Improve process	* QIT Sales	After survey	"	"
		D: Standardize and train	* QIT		New	Standard

Table 3. Task Deployment Table combined with PDCA Purpose Hierarchy for New Product Development Process Deployment. [Mazur 1995a]

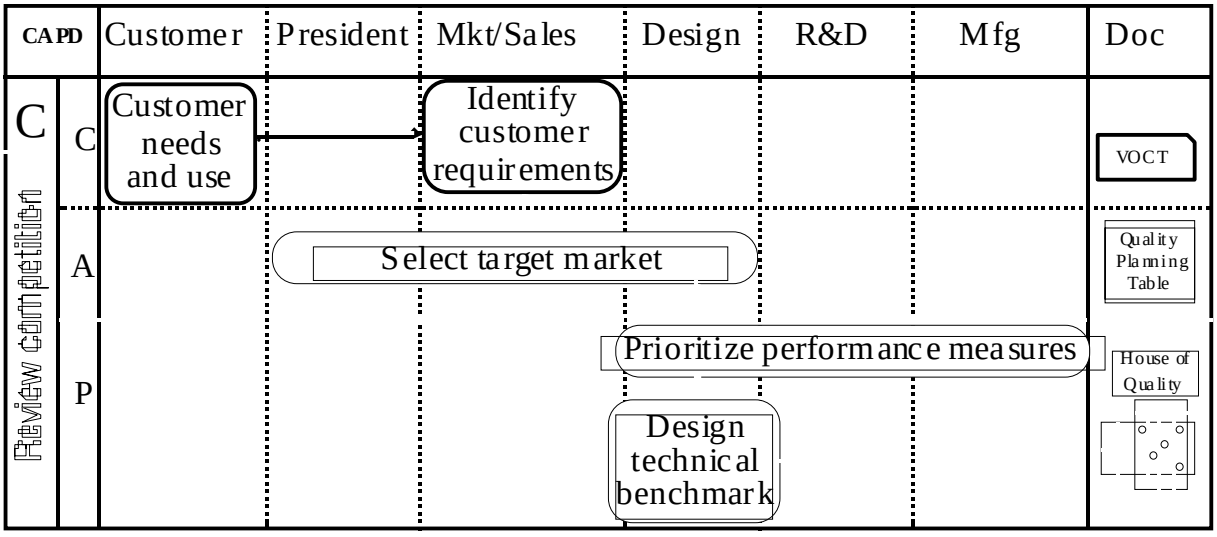


Figure 4. Quality Assurance Network Diagram for New Product Development Process. [Mazur 1995a]

After determining the *gembas* to visit, Task Deployment can be helpful in determining the makeup and activities of the team conducting the visit [Mazur 1997]. See Table 5. The Task Deployment Table can also be applied to defining the preferred makeup of the customer's team.

Documenting and Analyzing Customer Data

The observed and spoken data learned at the *gemba* can be categorized according to the different usage situations. The Customer Context Table (formerly the VOCT-1) has been used since the 1980s in QFD [Ohfuji et al 1990, Marsh et al 1991,

Who	What	When	Where	Why	How
Business travelers 60% of airport traffic	Break fast 75%	am week-days 60%	eat at kiosk 10%	in hurry, no time to stop on way to air-port 30%	eat plain 15%
Leisure travelers 20% of airport traffic	Lunch 5%	pm week-days 15%	eat in de-parture lounge 65%	transferr-ing flights during a meal time 25%	eat with topping 85%
Greeters and meeters 15% of airport traffic	Snack 20%	week-ends 20%	carry on board 25%	no food on air-plane 45%	
Employe		night			

Table 4. Customer Segments Table. [Mazur 1995, 1997]

Which	customers to visit?	employees at the customer?
Who	from your com-pany should go?	has what roles?
When	is the customer us-ing your product?	
Where	is the customer us-ing your product?	
What	information do you need?	problems/ opportuni-ties are customers facing?
How	will data be captured?	will data be analyzed?

Table 5. *Gemba* Planning Table. [Mazur 1997]

Mazur 1991a, 1992c, Nakui 1991]. The steps are explained here. See Table 6 [Mazur 1997].

1. Enter spoken and written words and observations verbatim, to avoid paradigms, into VOC column.
2. Record 5W2H3C1F data of customer use.
3. By filtering the verbatim data through the context of uses, extract true requirements and enter in the **Translated Data** column. Emphasize the customer's point of view.

Table 6. Customer Context Table Automobile Muffler. [Mazur 1997]

Verbatim	Who	What	When	Where	Why	How	Translated Data
Hi perform-ance, but car sounds quiet.	40 year old mail office worker	commute	morning, evening	highway	go to work	car pool	Accelerates quickly. Good gas mileage. Car is quiet. En-gine is quiet. Absorbs vibration.
Muffler doesn't rust out.							Muffler doesn't rust out. Pipes don't rust out.
Starts easily when cold.							Starts easily when cold. Starts easily

Service Task Deployment

When QFD is applied to a service product, the output of the study is often a detail of a new service process concept. The Task Deployment Table can be used to detail each step of the new process. See Table 7 [Mazur 1996a].

Detailed Service Implementation

Task deployment can be used to make specifications, guidelines, and requirements for vendors, suppliers, trainers, human resource staff, software developers, equipment manufacturers, architects, space planners, etc. This can also be helpful with compliance with the Americans with Disabilities Act.

Sorting the data in the Task Deployment Table by the appropriate column to extract the needed data, as in Table 8 can facilitate the planning aspects of the new service.

What	Who	When	How	How Much	Why
Divide work	Glenn	At start of project		per # translators	to assure even flow and work given where translator competent with subject matter
Translate	Translators (incl. Glenn & Mayumi)	14 hours/day	computer or by hand	*n* word/hour	to assure completion in 2 weeks
Type	Typist	as material available	computer	150 wpm	to type handwritten work
Edit	Glenn	as typed	using transcriber	4 hours/day	to assure natural sounding English
Retype	Typist	as transcribed	using transcriber	2 hours/day	to create final version
Send out	Mayumi	daily	fax	as available	so GOAL could do artwork

Table 7. Task Deployment Chart for Translation Service. [Mazur 1996a]

What	Who	When	Where	How	How much
Task flow.	Job descriptions; etc.	Schedule; Project management; etc.	Floor or area plan; Site location; Architectural requirements; etc.	Skill requirements; training programs needed; equipment requirements; conformance to Americans with Disabilities Act*; personality attributes; information and communications systems; etc.	Standards; equipment specifications; self check points; management control points; etc.

Table 8. Detailed Service Implementation by Sorting the Task Deployment Table. [Mazur 1996a]

Conclusion

Task Deployment has been a part of QFD since its inception in the 1960s. It is essential for the translation of both new product and new process changes to reach the level where the appropriate people can actually make their jobs comply systematically with the needs of both internal and external customers. Task Deployment should be considered an easy-to-expand tool that can be flexibly applied to a wide variety of people process situations. The author would be grateful for new applications to be brought to his attention.

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.

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