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CHAPTER SIX

Process Leaning

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CHAPTER 6

Process Leaning

Introduction

In the 1950s, W. Edwards Deming, who popularized the notion that continuous process improvement leads to quality production, developed many modern quality programs in Japan. Today, the practice *genba kanri,*[1] which loosely translates as "workshop management," is a movement to error-proof processes. The "5 Zs" provide the guiding principles. The Japanese word for "do not"—*zu*—ends each of the 5 "Z" words:

- *uketorazu*: do not accept defects.
- *tsukurazu*: do not make defects.
- *baratsukasazu*: do not create variation.
- *kurikaesazu*: do not repeat mistakes.
- *nagasazu*: do not supply defects.

Six Sigma is an error-proofing movement that was started at Motorola in the 1980s, borrowing from the Japanese, with the specific goal of allowing no more than 3.4 errors per million opportunities. A *sigma* is a standard deviation from a population mean. Six Sigma practice strives for 99.9997% accuracy in the process. *Lean Six Sigma* combines lean manufacturing discipline with Six Sigma's low defect goal. Leaning is the removal of waste from processes. Thus Six Sigma and lean are compatible with *genba kanri*.

In this chapter, we begin with the *uketorazu* stage by seeking to eliminate steps that do not contribute to organization profit or customer satisfaction. The first technique, value-added analysis, evaluates a process and "leans" out superfluous activities in preparation for developing proposed changes. Then we evaluate how to improve processes by eliminating defects and variations from processes—the *uketorazu*, *tsukurazu*,

and *nagasazu* stages. Finally, we introduce quality function deployment (QFD) as a tool to identify and choose between means for making changes. The other stages are discussed in the next chapter.

Value-Added Analysis

Value-added analysis (VAA) is a technique for removing nonessential process steps. There are four types of *event-driven processes*: customer affecting, management, primary, and support. A single process can have elements of more than one process type within it, and when analysis is done, part of the task is to tease out which type of process each step is conducting.

Customer-affecting processes are those for which a customer would pay. It forces one to think about what the customer actually is paying for. Management processes are those required for the organization to control and guarantee quality of its processes. Primary processes are those that are needed to allow the process to take place. For instance, in manufacturing, machines might need to be set up or calibrated before the manufacturing process takes place. Even though a customer would not want to pay for setup, it is still necessary. Secondary processes are those that are not germane to the process, such as moving raw materials from inventory. Both the inventory and the movement are secondary.

In conducting value-added analysis, we seek to identify each step as one of the four process types, keeping customer-affecting processes and evaluating all others to determine their real value to the organization. Then, after stripping all nonessential or non-value-adding process steps, the process is redesigned to perform in the most efficient way. Thus VAA is a prelude to the improvement process. It is a form of "leaning out" process steps that are of little organizational value. That is, according to lean Six Sigma tenets, waste removal is performed before perfecting performance of the remaining process steps.

A typical process by some estimates will have only 5% of its steps value adding (VA).[2] To be value adding, a customer must be willing to pay for the activity, and the step must in some way affect the service or product with 100% accuracy. Thus value adding and customer facing are the same thing. Flawed (non-100% accuracy) VA steps are also evaluated for their necessity and, if required, are then forwarded for root-cause (or

other) analysis of defects. An example of value-adding steps in a law firm, for example, are "analyzing case papers to develop a line of defense," or, in manufacturing, "rust-proof painting of a car's underside."

The remaining 95% of process steps are either non-value adding (NVA) or do not contribute to enhancing the customer experience. NVA steps can be further analyzed by type as management, primary, or support. Some activities of each of these types will be "necessary waste," as they respond to legal, regulatory, or other required activities to deliver a product to a customer. However, in each NVA category, it is possible to identify steps that are not necessary. Occasionally, there are steps that are considered "the way we've always done things" or that are responses to special requests from a manager or are of unknown origin. These steps should all be evaluated for elimination. Compliance actions that would otherwise not be conducted are an example of an NVA activity.

As waste analysis is performed, some activities will be identified that can be, or should be, completely eliminated. These are called non-value-adding, unneeded (NVAU) activities. In general, any activity that is not VA, not required by law, or not needed to maintain the organization as a going concern are NVAUs. Examples of NVAU activities in a law firm are "moving boxes of documents from one place to another," or, in manufacturing, "moving raw materials to the manufacturing floor."

To the extent possible, NVA and NVAU activities should be eliminated. One common acronym for the seven elements of waste is TIMWOOD (time, inventory, motion, wait time, overproduction, overprocessing, defect rework), but an easier one to remember is DOWNTIM[e], developed by Taiichi Ohno for Toyota,[3] DOWNTIM[e] includes the following items:

- *D*efects: anything not done according to specifications and correctly the first time
- *O*verproduction: making product faster, sooner, or more than needed. According to Ohno, overproduction leads to most of the other types of waste
- *W*aiting: time lost when people, material, or machines are waiting
- *N*onutilized talent: not fully utilizing the workers involved

in the process; not using the people closest to the actions and their knowledge
- *T*ransportation: any movement of parts, materials, employees, or customers creates waste
- *I*nventory: any material in excess is classified as one of three types—raw material, work-in-progress (WIP), and finished goods
- *M*otion: movement of people, product, materials, or machines that does not directly add value to the final product

When these activities are eliminated, they are replaced by improved processes, automated metrics, and controls. Since some NVA and NVAU activities may still be required, they are evaluated to minimize their impact on process time and cost. Minimizing may take the form of the following:

- minimizing time of item or process movement between people by moving the participants physically closer
- combining steps
- reassigning work done by several people to one person
- coproduction activities
- automating the task, thereby eliminating human activity
- outsourcing

To conduct value-added analysis, the following steps are conducted:

1. Map the process.
2. List all process steps and place them in a table with five other columns for duration, DOWNTIMe, and identification as value adding activities (VA), non-value-adding, but required, activities (NVA), or unnecessary non-value-adding activities (NVAU).
3. Review each process step, asking the following questions:
   A. Does this activity meet any of the DOWNTIMe definitions?
      i. If yes,
         a. Could this activity be eliminated if some prior activity were done differently or correctly? (If yes, then NVA)

   b. Could this activity be eliminated without impacting the form, fit, or function of the customer's "product"? (If yes, then NVAU)
   ii. If no, then VA
4. Evaluate all NVA activities for the potential to automate them.
5. Evaluate all NVAU activities for elimination or automation.
6. For NVA and NVAU activities that do not appear able to be automated or eliminated, mark them for further analysis for cleaning (chapter 7), for greening (chapter 9), or some other replacement with VA activities.

Figure 6.1 describes the steps in a simple process flow to create cabinet doors through only two manufacturing operations with the activities defined as VA, NVA, and NVAU.

As the figure shows, only two activities are actually required: cutting pieces and machining the doors. If all other activities could be eliminated or automated, the time could be substantially reduced. For instance, if just NVAU activities were eliminated, the process would be reduced by 96%, or by 152.75 hours, to 5.5 hours. The NVA activities are materials handling or machine setups, both of which are required even though they are not directly aiding the customer experience. Therefore, efforts would focus on the NVAU activities and their elimination.

In the example in Figure 6.1, the NVA activities might be improved as follows:

- Outsource raw materials management to the vendor and change to just-in-time management so there is no materials handling.
- Improve the manufacturing planning process to minimize setups for both operations, allowing, for instance, no more than one per shift.
- Move cut pieces directory to the CNC process area.

Value-added analysis, then, seeks to identify any process steps that delay, interrupt, reduce efficiency of, or duplicate other process steps. These are all non-value-added categories and are unnecessary steps. Once the NVAU steps are identified, the goal is to remove, automate, or at least

Activity	Description	Duration	VA	NVA	NVAU	DOWNTIMe
Material handling	Get panel stock	15 minutes			X	Move
Set up	Set up saw	15 minutes		X		Control
Saw	Cut pieces as required	30 minutes	X			
Queue	Store cut pieces	6 hours			X	Wait
Material handling	Move cut pieces to CNC	15 minutes			X	Move
Set up	Set up CNC machine	15 minutes		X		Control
Machine	Machine cabinet doors	4 hours	X			
Queue	Store machined pieces	2 days, 30 minutes			X	Wait

Figure 6.1. Value-added analysis for two-step manufacturing process.

handle those steps outside of the process, thus removing impediments to the process's speediest execution.

Advantages and Disadvantages of Value-Added Analysis

Value-added analysis seeks to drive wasted effort from processes. It is a useful technique with more advantages than disadvantages (see Figure 6.2).

Cost-of-Quality Analysis

According to the American Society for Quality, the *cost of quality* (COQ) is "the difference between the actual cost of a product or service and what the reduced cost would be if there were no possibility of substandard service, failure of products or defects in their manufacture."[4] Cost of quality comprises several components:

- *prevention costs*—the cost of all activities designed to prevent or provide on-the-spot remediation of defects or insufficient quality in products or services
- *appraisal costs*—the cost of measuring, evaluating, or auditing products or services for conformance to required quality standards or for required process performance
- *failure costs*—the cost of nonconformance to standards in either product or process performance

Advantages	Disadvantages
It identifies the minimal set of process steps needed to accomplish the process.	It can be time-consuming for complex processes.
It supports ISO, military, and other compliance efforts.	It may identify problem areas that an organization does not want to confront.
It can identify opportunities for automation.	
It is inexpensive.	
It is a useful precursor to strategy, resource, and policy realignment.	

Figure 6.2. Advantages and disadvantages of value-added analysis.

- *internal failure costs*—the failure costs incurred if the defects or failures are found before being shipped or provided to the customer
- *external failure costs*—the failure costs incurred if the customer discovers the defects or failures

In the ideal world, a company would not experience failure costs. The company would have provided sufficient attention to preventing errors such that minor appraisal, with even more minor failure remediation, would be required. Many companies adopting COQ tenets move from a position of weakness and many failures to one that is less than ideal but that approaches the ideal. The outcome of COQ management is to reduce the overall money spent on quality and to greatly reduce the amount of money spent on failure remediation, thus making cost of quality a desirable outcome to most companies. The following are examples of each of these types of costs:

- failure prevention
  - new product review
  - planning
  - training
  - preventive maintenance
  - quality improvement projects
- appraisal
  - raw materials inspection
  - in-process and final product inspection
  - audit
  - test and measurement
  - calibration
- internal failure
  - scrap
  - rework
  - downtime
  - concessions
  - overtime
  - corrective actions
  - retesting

- reinspection
- external failure
  - customer dissatisfaction
  - customer complaints
  - customer returns
  - loss of goodwill
  - administrative cost of dealing with a failure[5]

The worst outcome from low product quality comes from costs incurred to recover lost reputation, make concessions to dissatisfied customers, or to repay customers for losses incurred from low product quality. Ideally, through prevention programs, quality can be raised to a level that reduces overall cost (the size of the ideal circle in Figure 6.3 is smaller to indicate lower costs) and where most costs are preventive.

There is no one method of appraisal for quality improvement. In general, quality experts perform the appraisals. The experts are usually engineers who are able to analyze manufacturing processes to automate metrics, analyze all aspects of machine-human interaction, and improve equipment functioning. Similarly, there is no one way to accomplish prevention. For highly complex (e.g., computer chip or nano-sized manufacturing) or numerous step processes (e.g., telecommunications equipment), statistical process control is used. Other preventions are

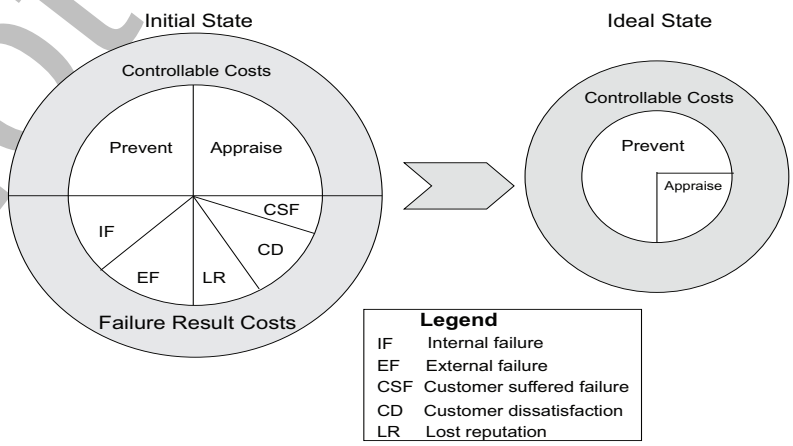

Figure 6.3. COQ initial and ideal states.

accomplished by perfecting every aspect of each step. These activities are more fully discussed in the next chapter.

Many companies do not believe that low quality reduces customer goodwill and that, in some captive markets, the impact may not be felt initially. But when alternatives become available, a dissatisfied customer will move to the alternative source. Open-source software, now a multibillion-dollar industry with thousands of products, was founded in response to shoddy quality of vendor software. The advantages and disadvantages of COQ analysis are listed in Figure 6.4.

Quality Function Deployment

Sometimes in process analysis, the lack of a current process or a high number of changes is such that complete rethinking of the process is warranted. *Quality function deployment* (QFD)[6] supports both design and redesign of processes. QFD is a technique for translating customer needs, requirements, and expectations into detailed product and process specifications. Therefore, while it can be used to analyze existing products, QFD is often applied to the analysis of new needs and requirements that determine the nature of a new product. QFD is very good for summarizing complex thought processes and competing analyses of a given situation. One disadvantage is that the data can be very complex to interpret because the diagram can actually present too much information. Another disadvantage is that many items require subjective judgments that can

Advantages	Disadvantages
Over time, overall cost of quality improvement management is less than the cost of failure management.	It usually requires engineering and quality training.
It can result in lower expenses, lower turnover, increase productivity, increase quality of service and product, and contribute to many other quality improvements.	It is time-consuming and expensive to implement.

Figure 6.4. Advantages and disadvantages of cost-of-quality management.

alter the outcome. By attending to the possible disadvantages, however, they can be managed.

QFD can provide the continuity of thought and process required to bring a product to market. Figure 6.5 shows how QFD can be used from defining a product concept through defining production documentation with the output of each step becoming the input to the next step. QFD, then, can be used for any part of a product development process, with its input either from a previous QFD analysis or from an existing product or process.

Thus QFD is a tool for translating customer needs, requirements, and expectations into detailed product and process specifications. Some uses for QFD are the following:

- customer requirements
- product concept
- product and process design
- idealizing process and product redevelopment
- prioritization of change process requirements

First, we discuss the mechanics of developing a QFD analysis, and then we discuss the process of developing the QFD. QFD builds a

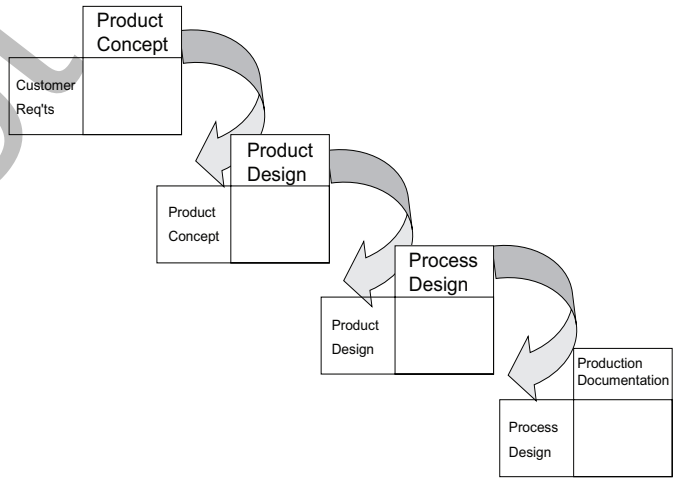

Figure 6.5. QFD for product development.

"house of quality" matrix (see Figure 6.6), with project goals ("what") in rows, means to reach the goals ("how") in columns, and the priority or quantity of each ("how much") in each cell. Each of these items—goals, means, and priority or quantity—are entered on a matrix such as the one shown in Figure 6.6. As appropriate, a goal may have multiple competing means. For instance, if you were analyzing alternative houses to purchase, the needs might be monthly payment, down-payment percentage, points, mortgage rate, duration, rate duration, maximum rate, and so on. The alternative means might be types of mortgages you have been offered, such as fixed 30-year, adjustable-rate 15-year, family loan with 15-year fixed rate, and so on. The cells would contain the specifics of each mortgage.

The next set of information completes the "house," as shown by the shaded areas in Figure 6.7. First, each need is prioritized or weighted in the "importance" section. Priorities can be a simple sequential ranking from 1 to *n*, where *n* is the number of needs, a portion of 100%, some percentage that need not add to 100%, or an integer that has meaning within the organization. In any case, the method of assigning importance should be defined and provided in any reports so that the reading audience understands its rationale. In general, since rankings are subjective, simple is better because it is more defensible and understandable.

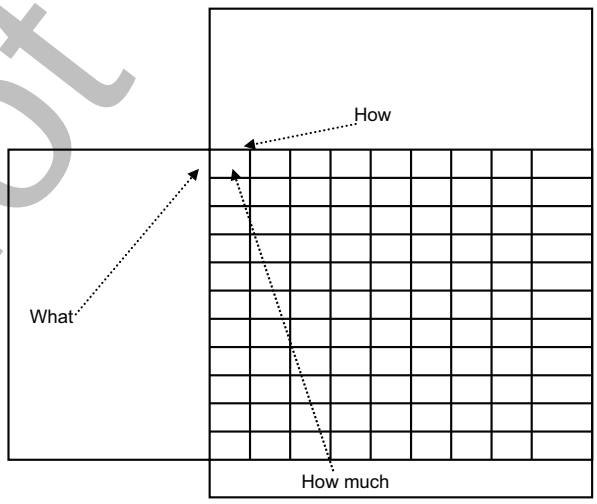

Figure 6.6. QFD basic relational matrix.

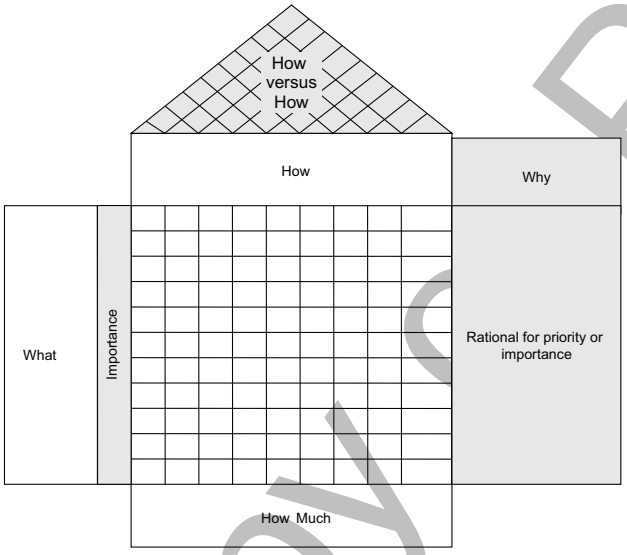

Figure 6.7. QFD house of quality.

Priority assignment is subjective, so it is important that the criteria be clearly defined for each need and entered on the right side of the QFD matrix. Criteria examples include cost of materials, process complexity, environmental impact, customer preference, and so on.

Next, the methods of implementing the requirements being analyzed (the "how") are listed across the top. Then, a simple visual method that includes the symbols suggested in Figure 6.8 is used to identify the relationships of methods to requirements in each need-mean cell. Notice that the number assignments for relationship strengths in Figure 6.8 are significantly different. This is to ensure that strong relationships are accorded the importance they should have. Not all symbols are used in all analyses. For instance, not every analysis will have negative relationships.

Above the means ("how") and below the "roof" is an area that shows the type of measure, or amount of the means, that is desired. The three possibilities are absolute—that a specific amount of the item is needed, or minimized; that the least possible amount is desired, or maximized; or that the maximum possible amount of the means is needed. These possibilities are identified by arrows or a circle, as shown in Figure 6.9. These entries provide information in the QFD but are useful later when the metrics for determining process success are developed. Absolute measures

Symbol	Relationship	Relationship Strength
◎	Strong	9
○	Positive	3
△	Weak Positive	1
×	Negative	–3
⋇	Strong Negative	–9

Figure 6.8. Relationship symbols.

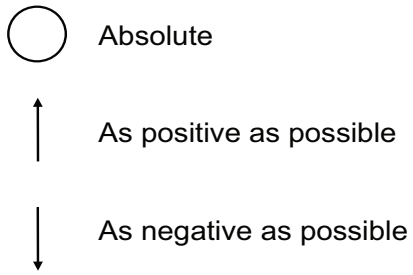

Figure 6.9. Measurement symbols.

require count-type metrics, where minimal or maximal type measures require continuous metrics. These are discussed more fully in chapter 10.

The cells of the triangular "roof" of the house compare means of meeting needs. For instance, in the mortgage example, the roof analysis would compare the different mortgage types to identify which benefits could be combined to provide a "perfect" mortgage.

The symbols used in the roof seek to identify the impacts of the product. Impacts can be color coded and relate to more than one entity (e.g., one set might identify environmental impacts, while another set might identify capital-budget impacts). Symbols used for impact analysis can be

the same as those used in the body of the QFD analysis; however, because they are often not sufficient, other commonly used symbols for the roof are shown in Figure 6.10.

Another area of the house of quality is the right side of the diagram, which seeks to answer "why" questions about the entries. This area also can be used for several types of information. Two common uses follow. First, in developing marketing plans or products, the right side can provide columns for benchmark information of this company versus its competition, industry average, or best practice. The use of benchmark data provides an instant check on the importance of each need. Second, the area is also used in product development QFDs to identify the rational for priority definition, with a rationale provided on each row's "need" entry. This is useful for deflecting any political discussion that might relate to how needs are prioritized.

The last area is the "basement" of the house, which seeks to answer questions of "how much" in terms of the means entries. This area may also contain several types of information, including raw materials costs or amounts, financial contribution or margin for a product feature, or other supply chain or financial information.

To begin developing the QFD "house of quality," the following steps should be taken:

1. Define the needs for the analysis down the left side. This is the "what" information being analyzed.
2. Develop the priority system, and rate each need.
3. Define the means, sometimes called quality characteristics, to reach the needs across the top. This is the "how" information in terms of how the needs will be accomplished. More than one means may be

✓ ✓ Strong positive impact

✓ Moderate positive impact

X Moderate negative impact

XX Strong negative impact

Figure 6.10. Technical impact symbols.

entered for each need so that analysis of costs and interrelationships between means can be conducted. Eventually, the best method for accomplishing each need is developed.

4. Define the ranking system for strength of relationships between the needs and the means (e.g., similar to Figure 6.8).
5. Compare each need or means pair, and enter the symbols for the relationship strength in the corresponding matrix cell. In performing this analysis, think of the means as the only method of meeting the need. If it were the only method, the strength is the extent to which it could fully achieve the need. If there is no relationship, the cell is left blank.
6. In a horizontal row above the means, enter the type measure to determine success for that means. There are three measures—absolute, as positive as possible, and as negative as possible. Figure 6.9 depicts the symbols used for these entries.
7. As appropriate, analyze the extent to which means are competing or cooperating for producing each good in the crosshatched "roof" area of the "house." The entries in the crosshatch cells represent relationships between different means of accomplishing all needs. Cooperative, positive relationships are defined as means that—as they are met—facilitate the use of another mean. Competing, negative relationships are identified when one means impedes the use of some other mean. For instance, in building a house, added BTUs to an air conditioner will increase the weight-bearing needs of the location in which it is placed. Technical impacts can use the same symbols as in Figure 6.8; however, some authors[7] recommend other symbols, such as those in Figure 6.10. In addition to using the symbols, there is the option of identifying the direction of impact—from the left means to the right or vice versa—by including an arrow above the symbol in the cell. If there is no relationship, the cell is left blank.
8. Compute the total numeric value for needs relating to means by summing across the row, and then multiplying the sum by the priority rating for each need in order to derive the weighted importance of each need.
9. Evaluate the roof impacts to develop the best set of means for accomplishing the needs with the fewest negative impacts.

10. To develop organizational impacts of the entire set of needs and means, a responsibility matrix can be developed to show each organizational role by means and who should have primary or supporting responsibilities and who should be informed. The same symbols used for the cell–means matrix can be used for this matrix.

Other analyses can be added to a QFD, but every addition decreases its understandability. Some analyses include, for instance, customer ratings of goals, compliance goals and their importance, raw materials needed to accomplish each means, competitive engineering assessment for raw materials conversion, or various measures of importance of means to a project and difficulty in implementing each means.

QFD Analysis

An example of a QFD analyzes alternative solutions for problems found in a call center. The company suffered from inconsistent processing by service representatives, errors in recording call outcomes, nonstandardized contracts, and contract information that was verbally transmitted to the dialer administrator responsible for setting the equipment to meet contractual agreements. As a result of these issues, the company's billings were decreasing. The "needs" in the QFD analysis in this case were recommendations to remedy these issues, with one goal of prioritizing recommended changes for implementation. The main purpose of the QFD was to develop recommendations about how to accomplish the needed changes. During the discussions, responsible parties for each change were also identified.

The first step was to list the needs, as shown in Figure 6.11. For each goal, a priority is defined. The prioritizing method used assignment of priorities such that the sum of all priorities equals 1.0. In the call center example, only two goals—accurate payment and accurate billing—were considered more important than the others. These two goals are assigned priorities of 0.2, while all other goals are assigned priorities of 0.1.

Discussion regarding which goals to list mainly focused on whether or not to include "increased customer satisfaction" as a goal. The three main call-center customers were solicited about what aspects of call-center capabilities they valued most. Their answers were very uniform and specifically

Direction of Improvement	
Customer Requirements/Solutions	**Priority**
Accurate Contract Information	0.1
Accurate Campaign Information	0.1
Accurate Collection Information	0.1
Accurate CSR Information	0.1
Accurate Payment Information	0.2
Accurate Termination Code Processing	0.1
Accurate Management Reporting	0.1
Accurate Billing	0.2

Figure 6.11. QFD goals.

addressed "meeting contractual agreements," "proving that contracts were met," and "providing accurate collection and billing information." As a result of the discussion and these customer requirements, the overall goal of increased customer satisfaction was omitted.

Discussion about goal priorities centered around which goals were most important. Accurate collection information was viewed as at least as important as accurate payment information. But the group decided that if accurate payment information was necessary, the related need for accurate collection information was also required. Therefore, the more important goal was accurate payment information. Similarly, accurate billing information was considered a higher priority because it was the true measure, available to clients, of the call center's compliance with contractual agreements. All other goals were viewed as relating this goal.

The next step was to develop the means for meeting the goals. To keep this analysis reasonable, not every method of meeting a goal was provided. The recommended changes include the following:

1. Standardize contracts.
2. Develop a quality review of contracts.
3. Standardize campaigns and campaign information.

4. Develop a quality review for campaigns.
5. Develop a form to convey campaign information (and make it available on an intranet).
6. E-mail contract and campaign information to customer service, IT, and the call center as they are completed.
7. Develop a dual-write capability to provide backup for the Davox dialer-resident collection database. This recommendation also included the discontinuation of the dual-write capability on a second IBM AS/400 computer system.
8. Create custom software to error-proof collection software and process.
9. Create custom software to error-proof customer service representative (CSR) logon.
10. Create custom software to error-proof dialer admin campaign handling.
11. Develop a capability to reconcile collections (called "sales") on the diagram daily.
12. Develop procedures to improve quality controls on billing information.
13. Standardize and create new management reports for the call center. To the extent allowed by contracts, discontinue customer reports for each customer unless paid for by the client.

It was decided that in-house development of all needed software would be recommended. Further, all goals would be analyzed and prioritized based on this assessment, with the highest priorities developed first but with all changes to be implemented eventually. The means are listed across the top of the QFD; then, an analysis of which means relate to which goals is conducted and entered into the cells. As Figure 6.12 shows, most of the means relate to providing accurate management reporting and billing. The most important single goal is providing accurate payment information.

To complete the QFD, several other analyses are conducted (see Figure 6.13). The relationships between means are analyzed in order to define which relationships should provide synergistic positive impacts when implemented. The direction of improvement was added under the "roof." At a minimum, absolute measures for contracts, campaigns, forms and e-mail, Davox double-writes, daily reconciliation, and standardized

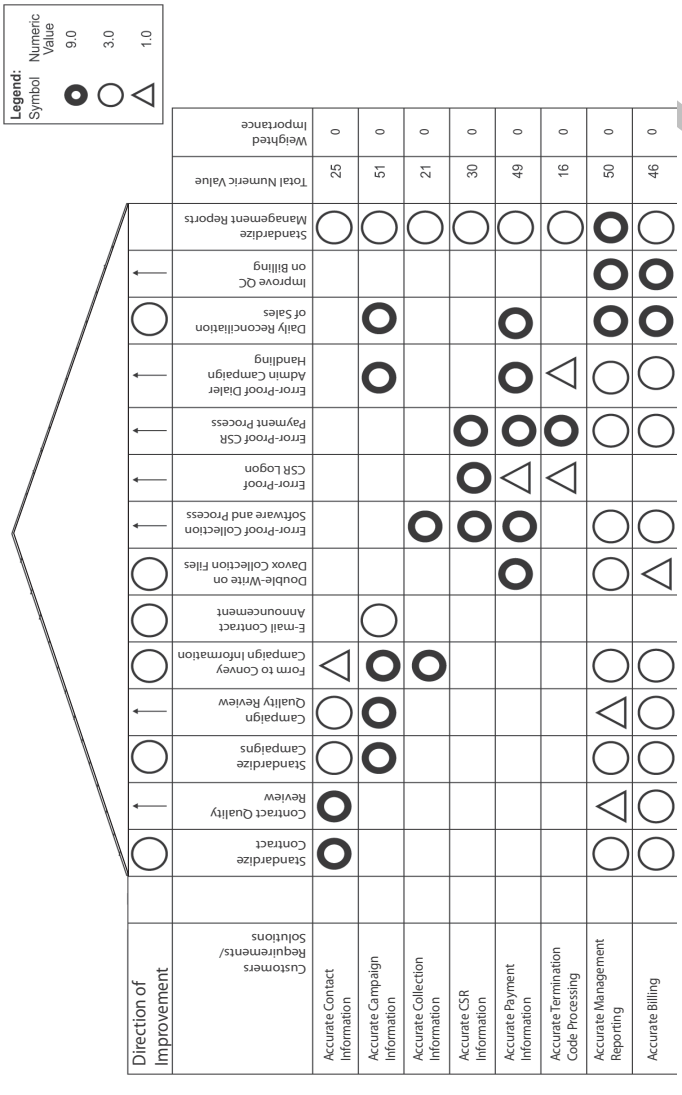

Figure 6.12. Goals and means relationship assessment.

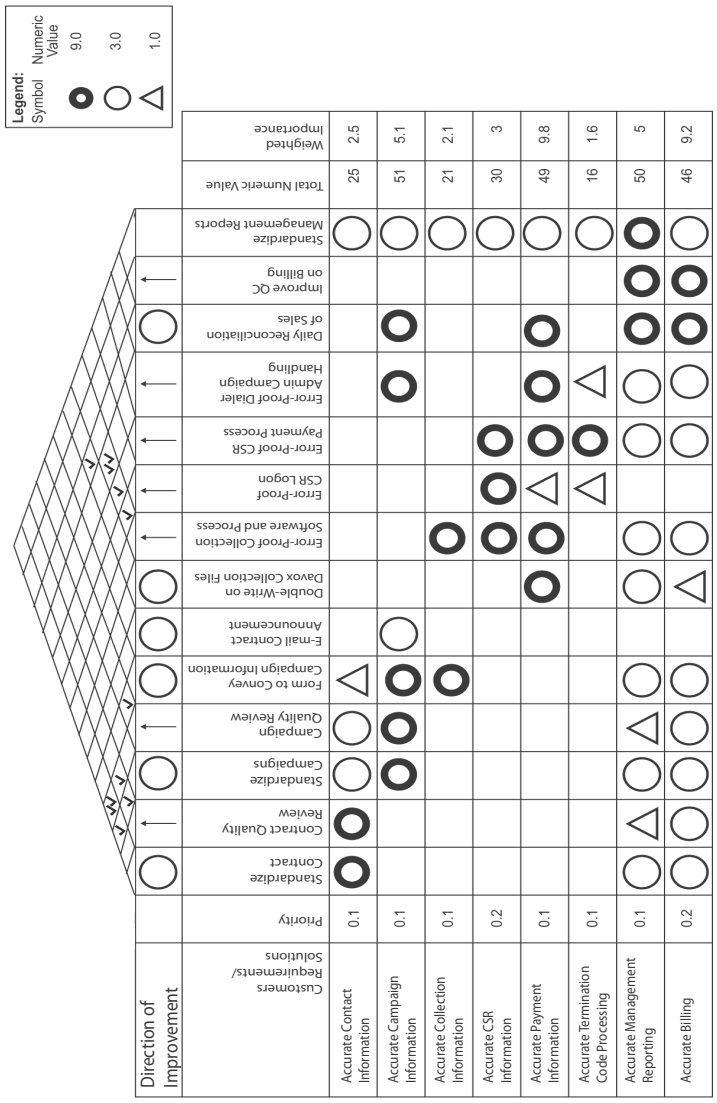

Figure 6.13. Completed QFD.

management reports all require "count" measures, while the others require measures that show the extent to which the item is present. All means need baseline measures against which improvements will be compared.

The numeric entries on the right side of the QFD show the total and weighted value of each goal in terms of impacts across the means. This measure supports development of priorities for implementation. With the highest rating of 9.8, providing accurate payment information is the highest priority goal. This goal has a strong positive relationship with the Davox dual-write, all error-proofing activities, and daily reconciliation recommendations. These tasks then become the highest priorities for development.

The final analysis in this section is development of the responsibilities matrix shown in Figure 6.14. This matrix shows organizational responsibility for the changes to be made to call-center support software and related organizational processes. The marketing organization is tasked with the standardization of contracts and campaigns. In assigning this responsibility, the executive committee charged the marketing group to assume no customizing except for the contracts of the largest customers.

One recommendation for the customizing of contracts might require approval of the chief operating officer. Further, it was recommended that the marketing, call center, and customer service departments be jointly charged with developing a form for campaign information that would be generally available for use within the company. Only terms of contracts tied to the call center or service support departments would be made public.

It was also recommended that the chief information officer (CIO) and IT organization take responsibility for all of the software changes, making decisions concerning whether the development was insourced or outsourced. Another recommendation was that responsibility for daily reconciliation and improved quality control for billing should move from the IT operations manager to the accounting department. Errors found because of missing records, for instance, would be referred to the CIO for tracking of bugs and software fixes. While this reduces the responsibility of the IT operations manager, it was also expected to increase the quality of information on which billings were produced and therefore should also increase the quality of information provided to clients.

Legend:

◎ Primary ○ Support △ Inform

Tasks/ Organization	CIO	Operations	Call Center	Customer Service	Marketing	Accounting	Finance	Executive	HR
Standardize contacts					◎			◎	
Develop contract QC procedure					◎			○	
Standardize campaigns and campaign information		○	○	○	◎			○	
Develop campaign QC procedure				○	◎			△	
Develop campaign form			◎	◎	◎			△	
Develop intranet	◎	◎	○			○		○	○
Develop procedure for e-mail contract and campaign information		○	○	◎	○			△	
Set up e-mail for all employees	◎	○	△	△	△	△	△	△	△
Develop Davox dual-write capability	◎	○	△					△	
Create software to error-proof collections	◎	○	○					△	
Create software to error-proof CSR logon	◎	○	○					△	
Create software to error-proof campaign handling	◎	○	○					△	
Develop daily reconcilliation capability	△		◎	△		◎	○	○	
Develop QC for billing information	△		△			◎	○	△	
Standardize new management reports	◎	○	◎	○	○	△		○	

Figure 6.14. Responsibility matrix.

Advantages and Disadvantages of QFD

QFD is a complex but value-adding analysis for evaluating competing alternatives. The QFD advantages and disadvantages are listed in Figure 6.15.

Summary

Value-added analysis is a method of documenting the steps of a process and defining the type of activity it is: customer-facing, support, administrative, or other. All "other" steps are further analyzed to determine whether needed, and the steps are eliminated when feasible. Similarly, support and administrative steps are analyzed to ensure they are as efficient as possible and required for this process. For non-value-adding steps that are still required, preferred outcomes include either removing the steps from having an impact on the process or automating the steps. Any activities that are not required are removed as a prelude to process redesign.

COQ analysis determines the difference between actual cost of a product or service and the cost of the product or service if there were no failures or defects. COQ seeks to move all or most costs of quality into prevention and appraisal and to remove all failure costs relating to

Advantages	Disadvantages
It can result in products that tie all features and functions directly to customer requirements.	It is time-consuming and expensive to implement
It can show benchmark, supply chain, financial, and trade-off information in a single place.	It requires practice and expertise to properly develop a QFD analysis.
It supports the thinking required to develop a complete summary or decisions relating to product concept definition, product design, process design, engineering design, and production documentation.	Information can be complex to interpret.
	Many subjective judgments are required during QFD that can alter the outcome.

Figure 6.15. Advantages and disadvantages of quality function deployment.

internal failures, such as scrap, rework, downtime, and so on, as well as external failures found by customers, such as complaints, returns, and dissatisfaction.

QFD is useful for requirements, concepts, designs, idealized processes, and many other analyses. By matching business goals to alternative prioritized means, an organization can develop an analysis of effects of means on each other. Outcomes include prioritized goal actions and means of meeting the goals, as well as raw materials, costs, and many other details. The use of symbols to depict relationships creates an easily digested presentation of the information. Symbols are also used to describe the effects of different means on each other and the direction of success for using a means. Another useful outcome of QFD analysis is responsibility matrices, which delineate tasks and responsibility assignments.