BUSINESS PERFORMANCE MANAGEMENT

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TITLE

Managing Quality Improvements

CREDITS

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INSTITUTE OF MANAGEMENT ACCOUNTANTS
Advancing the Profession™

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I. RATIONALE

The world economy has changed. Enterprises in many countries now have the ability to compete globally. In many sectors, supply exceeds demand. Consumers faced with greater choices have become more cost- and value-conscious, and are turning to alternative sources for products and services. Consumers are also demanding improved quality. A customer lost because of a quality problem may never return but, more importantly, may take other customers with him or her.

In the economic marketplace, every enterprise is required to define its chosen battlefield and competitive weapons. Today, quality, cost, innovation and response times to customers are the competitive weapons of choice for the successful enterprise.

In the 1970s and '80s, traditionally managed businesses that competed with those that mastered total quality management lost markets that they previously dominated. The successful companies proved that a better quality product or service, produced and delivered in a timely manner, can be less, not more, expensive for the producer.

Quality, cost and time frequently seem to conflict with one another, necessitating trade-offs. These conflicts exist because traditional cost accounting practices do not always consider the hidden costs of (poor) quality. For example, an executive in the computer industry once observed, "If you catch a faulty two cent resistor before you use it and throw it away, you lose two cents." However, if you don't find it until it has been soldered into a sub-assembly, it may cost $10 to repair the part. And if you don't catch it until it is in the computer, the expense may be well in excess of the manufacturing costs.

This is illustrated by the Quality Lever for a manufacturing company (see Exhibit 1).

Traditional accounting practices measure product costs at the end of the manufacturing process. This process identifies and captures a limited amount of savings by focusing on scrap, rework, testing, etc. But if the quality cost opportunities were identified in the inspection stage before the manufacturing process was finalized, the savings would be greater.

Similarly, the savings would be even greater if quality and cost opportunities were identified in the product design phase.

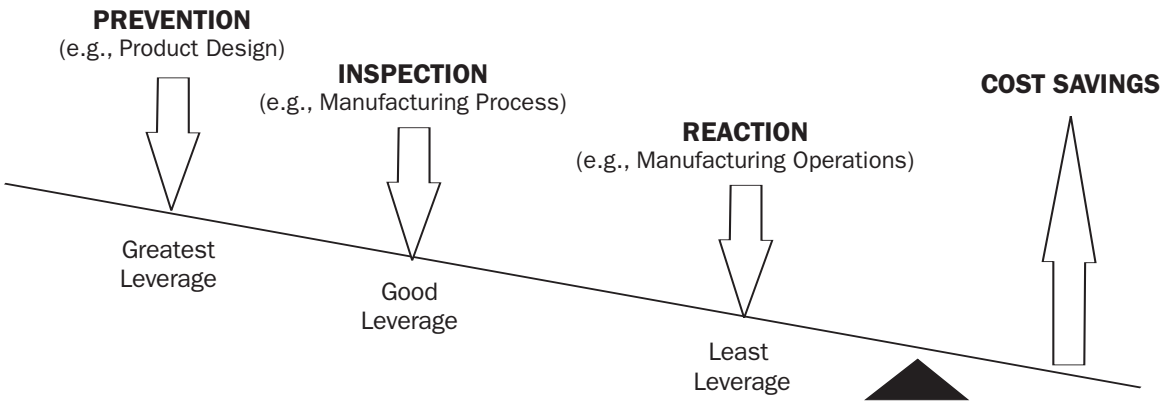
Unfortunately, the "fire fighting" mode of problem solving at the production stage frequently occurs. Enterprises tend to focus on solving instead of preventing problems. While they may not have consciously decided to do this, enterprises fall into a pattern of behavior that favors the "find and fix" approach. Hence, there is a need for a disciplined quality management that will redirect all efforts to improving quality in all stages, from the concept of the product or service through to its delivery to the customer.

II. SCOPE

This guideline provides practical operating principles and recommended approaches for implementing Total Quality Management (TQM). It is addressed to management accountants so they can fully employ their unique skills in the quality management process. It is designed to:

- help make the management accountant a key contributor to the achievement of quality through the use of Cost of Quality, statistical measures, and other quality management tools and processes.

EXHIBIT 1. QUALITY LEVER



- help in implementing the initial process of a TQM system and the on-going continuous improvements in the enterprise.

This guideline assumes an organization where the decision to implement a TQM process has already been made.

The guideline is, of necessity, both descriptive and prescriptive. The descriptive parts shape a vision of the future, build commitment for the change, and define quality concepts and techniques. The prescriptive part addresses how to lead, plan, and implement TQM.

The concepts, techniques, and the case study included in the guideline are all structured to be applicable to:

- businesses that produce a product or a service;
- all levels of an enterprise, from the CEO down;
- all functions in an enterprise; and
- enterprises in all business sectors.

III. DEFINING QUALITY

Quality, like excellence, is a concept that is easy to visualize but exasperatingly difficult to define. It remains a source of confusion to managers. Quality improvement is unlikely in such settings. Even when quality has been precisely defined, it has been focused narrowly on the factory floor or has relied primarily on traditional methods of quality control. Little attention has been paid to the underlying sources of superior quality, such as contribution of product design, vendor management and selection, production and workforce management.

Quality remains a difficult concept because it has undergone a significant evolution since the 1950s. Quality methods have expanded in ever-widening circles, each incorporating the elements of the preceding method.

During the evolution of quality, five principal approaches to defining quality have been tried. These are:

- *Transcendent:* Neither mind nor matter. I know it when I see it.
- *Product-based:* Quality of product ingredient or attributes, such as performance, features, reliability, durability, serviceability and aesthetics.
- *User-based:* Ability to satisfy wants.
- *Manufacturing-based:* Conformance to specification.
- *Value-based:* Quality at an acceptable price.

These differing approaches co-exist because of the competing views of quality held by members of the marketing, engineering and manufacturing departments. Despite the potential for conflict, an enterprise can benefit from such multiple perspectives. Reliance on a single definition can cause problems. For example, a company may discover that its product does not meet customer requirements, even though it conforms to all the specifications. Conversely, the customer satisfaction rating may be very high, but at a high cost of rejects, scraps, rework, and warranty costs.

In both cases, managers thought that they were producing high-quality products. And they were, but according to only one of the approaches to quality described above. Because each approach has a blind spot, TQM encourages multiple perspectives on quality, actively shifting the measures of products more from design to quality.

The TQM concept is the most comprehensive quality concept to date. It is no longer an isolated, independent function dominated by technical experts. It has entered the corporate mainstream, becoming an activity as worthy of attention as marketing or production.

IV. TOTAL QUALITY MANAGEMENT

TQM, as discussed in this guideline, integrates the contributions of major quality masters such as Deming, Juran, Taguchi, Ishikawa and Crosby. The TQM approach starts with identifying the customers and their requirements.

Every function, and every individual within a function, has a set of customers. Each of these customers has a set of spoken and/or latent needs or requirements.

The focus on the customer-supplier relationship is crucial to any attempt to improve quality. This recognizes that everyone in a process is at some stage a customer or supplier of someone else, either inside or outside the organization.

At an enterprise level, TQM starts with the external customer requirements, identifies the internal customer-supplier relationship and requirements, and continues with the external suppliers. In a chain of operations to produce a product or service, there are many internal customer-supplier links. The ultimate, external customer is better served if each internal customer is also served to the fullest–in terms of timeliness, completeness, and accuracy (See Exhibit 2).

Understanding and meeting these customer requirements completely is the premise of TQM. See Exhibit 3 for an example using a manufacturing company.

The implementation of TQM requires care because the various customer requirements are not always translated properly. The traditional structure of large organizations and the complexity of the product/service delivery processes often stand in the way.

For example, most companies are organized, out of necessity, along vertical reporting hierarchies. But the delivery of a product or a service requires a great deal of cooperation among horizontal linkages.

The horizontal linkages in large organizations tend to be weak and lead to differences in interpretation and conflicting priorities. If the product development cycles are long, several key players may also change or be promoted before completion of the output.

Because of these complexities, TQM needs to be formally articulated and understood across all horizontal and vertical linkages. Ford utilized this concept to develop the Ford Taurus and Mercury Sable. To bring these cars to market, a cross-function "Team Taurus" was organized to strengthen internal linkages and to ensure that quality was designed into the new cars at every stage.

V. THE ROLE OF MANAGEMENT ACCOUNTING

Traditionally, the management of quality has been seen as the exclusive domain of the quality management staff, manufacturing and production engineering department personnel, and product design and engineering department personnel.

On the other hand, the modern concept of TQM is seen as a company-wide function and need that requires many new players.

Most existing quality information gathering, measurement and reporting systems have been developed and operated by non-accountants. The problem with these systems is that quality data are seldom accumulated and reported in a manner that emphasizes quality costs and clearly indicates the impact of quality on financial performance. Instead, these cost/benefit relationships are buried in a variety of product cost, marketing, engineering, and service department accounts.

Since management accountants are trained in analyzing, measuring, and reporting information focused on user needs, their expertise can be of assistance in the design and operation of comprehensive quality information gathering, measurement, and reporting systems.

EXHIBIT 2. TOTAL QUALITY MANAGEMENT

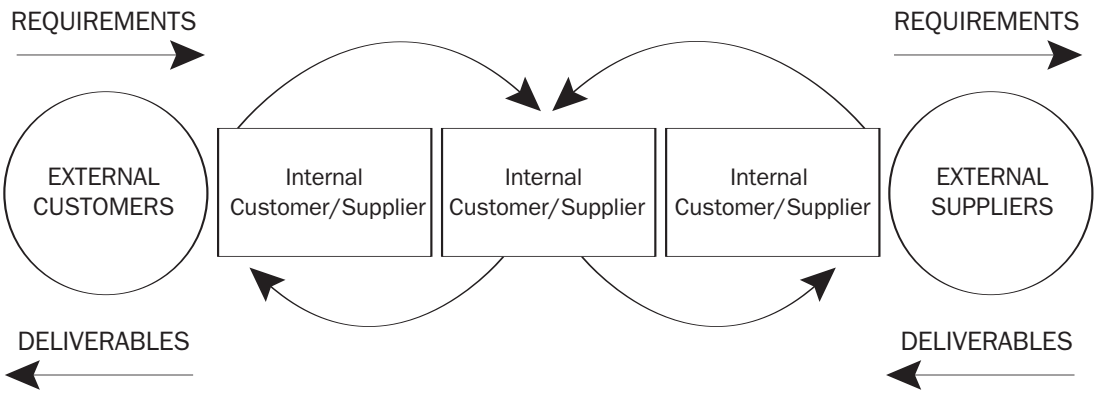
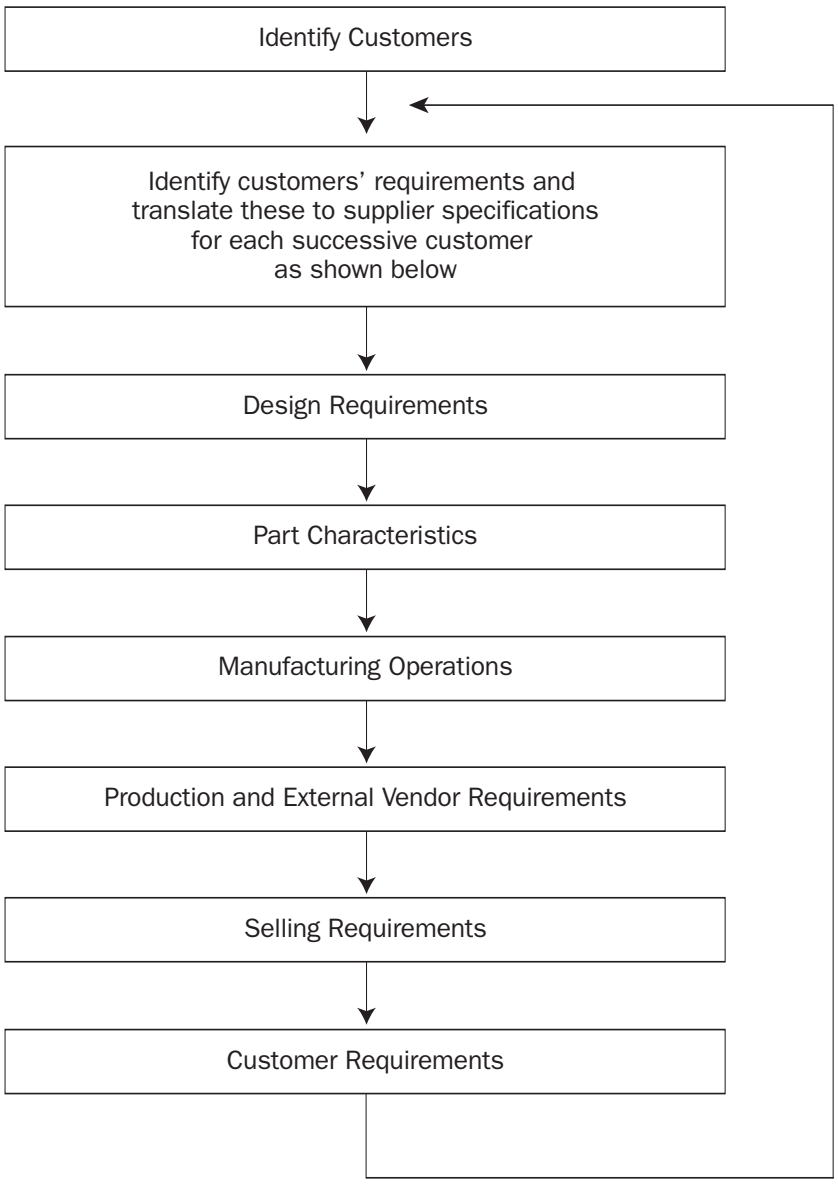


EXHIBIT 3. TQM FOR A MANUFACTURING COMPANY



To leverage this advantage, management accountants should integrate quality cost systems into the existing management reporting and measurement systems. With full knowledge of cost concepts and allocation procedures, they can measure and report quality costs in a manner that will contribute to the solution of quality problems. (The case study in Appendix 1 highlights this further.)

These efforts will enhance the role and responsibility of the management accountant in the enterprise. He or she can highlight the fact that poor quality can be a significant cost driver. The absence of good materials, trained labor, well-maintained equipment, and well-conceived management processes can dramatically increase quality costs. These include scrap, rework, excess inventories, process and equipment breakdowns, field service, and product warranty claims.

As an example, the material management function in some organizations is evaluated on a purchase price variance from standard cost. This encourages the acquisition of materials on a price basis alone rather than on the merits of design quality and price. If low-cost materials do not possess the right quality, this accounting process results in high manufacturing costs. Such costs include scrap, rework, schedule disruptions, etc., all downstream functions for which the material management function is not accountable. If not managed, the downstream costs of this lack of quality could exceed the price savings achieved.

The management accountant should be totally involved in all activities of the enterprise. The following activities illustrate the role of the involved management accountant.

- ensure that he or she is well represented on the main quality control committees and employee involvement teams;
- ensure that the company knows the competitive benchmarks, competitive gaps, customer retention rate, and the Cost of Quality;
- help identify areas of greatest quality opportunities;
- create a system of quality measures to monitor on-going progress against quality goals. The existing reporting systems may need extensive reworking;
- ensure that accounting is involved intimately in vendor rating decisions;
- ensure that he or she takes part in selection procedures for new manufacturing equipment by attending outside trials and viewings;
- discuss quality control effectiveness and the value of training courses for quality control personnel and operators with the human resources department;
- continually review scrap and recovery costs and the basis of their evaluation.

In service industries, some adjustment from the management accountant's role may be required if:

- services are delivered away from headquarters, at customer premises, and in direct interface with customers; and
- operating personnel (i.e., repair technicians) are away from headquarters.

The management accountant should be informed and willing to be an active participant in the TQM process. The management accountant's training and field of expertise will be of value in this process but the achievement of quality goals will not be driven, only aided by the application of such expertise.

VI. TQM IMPLEMENTATION GUIDELINES

The overriding lesson to be learned from the evolution of quality in Japan is that there are no easy answers. TQM cannot be reduced to a cookbook. Many early converts to the quality approach implemented quality circles, work teams, and other faddish techniques that merely copied the Japanese style while missing its substance. Each enterprise that has implemented TQM has developed its own implementation plans. TQM does not occur overnight; there are no shortcuts. It took the Japanese more than 15 years to approach and then surpass the quality levels of the West.

In general, the movement within an enterprise from traditional management to TQM will take between three to five years and will be difficult as well as time consuming. Many specific projects along the way, however, can yield high returns quickly.

While there is no one perfect implementation prescription for TQM, the following 11 phases have been used by the winners of the U.S. Malcolm Baldrige awards for effectively managing quality.

Year 1

- Create CEO/Quality council and staff
- Conduct executive quality training programs
- Conduct quality audit
- Prepare gap analysis
- Develop strategic quality improvement plans.

Year 2

- Conduct employee communication and training programs
- Establish quality teams
- Create measurement system and set goals.

Year 3

- Revise compensation/appraisal/recognition systems
- Launch external initiatives with vendors
- Review and revise.

Create CEO/Quality Council and Staff

Most companies seeking to implement TQM have found the transition impossible to achieve without the direct involvement of the most senior managers, including the chief executive/president. Leadership for such a change cannot be delegated. It requires active, unwavering leadership from the CEO. If it means no more than a few speeches and a lapel pin, quality will not work. CEOs must lead this change. Most TQM companies establish an executive-level quality council to oversee the change process, chaired by the CEO or president and composed of the top management team. The council develops quality mission and vision statements, the company's long-range quality strategy, and company-wide quality goals. To support the council, some TQM companies develop a small quality staff to coordinate and track the quality improvement process, provide technical guidance and oversight to improvement teams, develop the content of quality training, and assist professional trainers. Other TQM companies look to major segments of the total organization to manage this activity and provide the required information to the corporate offices.

Conduct Executive Quality Training Programs

Most TQM companies invest considerable time and effort raising senior management's awareness of the need for a systematic focus on quality improvement, creating a common knowledge base concerning total quality, establishing reasonable expectations, and avoiding misunderstandings and miscommunications as the change effort progresses.

Conduct Quality Audit

The quality audit assesses the effectiveness of efforts to provide background information to support the development of a long-term strategic quality improvement plan. It may include an analysis of the quality improvement initiatives and quality performance levels of "best-in-class" competitors to identify the company's strengths and weaknesses versus the competition. It should also identify improvement opportunities that are likely to provide the greatest return to the company in both the short and long term.

Prepare Gap Analysis

A gap analysis against the "best-in-class" competitors tells a company what it lacks to move from one point to the other or to "leap-frog" the competition to become the new industry leader. It identifies strengths, weaknesses, and target areas for improvement, which are then fed back to managers and employees. The purpose of the gap analysis is to provide a common objective data base from which a strategic quality improvement plan can be developed.

Develop Strategic Quality Improvement Plans

Next, the quality council sets priorities for quality improvement by developing a one-year short-term strategic quality plan and a five-year long-range plan based on the gap analysis and target criteria. Successful TQM plans need to have the support and participation of every group in the company—including unions, where they exist.

Conduct Employee Communication and Training Programs

Training is used both to communicate management's commitment to total quality and to provide employees with significantly enhanced skills in data analysis and problem solving. Training should be done from the top down: managers who actively participate in staff training reinforce the importance the company attaches to quality improvement.

Establish Quality Teams

Most successful TQM companies use a wide variety of employee and management teams. In addition to work-unit and self-managed teams, companies have devised quality management boards to oversee the continuous improvement effort for their line of business and quality task forces. These are temporary teams that address cross-functional quality teams.

TQM coordinators should serve as monitors for quality teams. But if the workforce has been provided with proper TQM training, then the teams should be able to structure themselves and handle problems on their own.

Unique quality teams, including representatives from the areas involved and a chairperson from an unrelated area, should be assembled to handle specific problems. Involving people from unrelated areas gives everyone a chance to share their experiences on how the TQM process has worked elsewhere.

A target should be established at the outset of the company's TQM process as to the number of quality teams and issues that will be dealt with at any one point in time. This will ensure that resources are not being spread too thin and that issues are being resolved before new topics are added to the process.

Create Measurement System and Set Goals

Crucial to the success of TQM implementation is the ability of quality teams to develop a better understanding of their internal and external customer needs and expectations, and to develop measures that truly reflect these expectations.

Frequently, TQM companies find that traditional measures are not only inadequate, but misleading, and must be overhauled or discarded. They adopt high goals that call for improvements by tenfold or more over the span of a few years. They also measure their performance against not just the "best-in-class" among their competitors but the "best-in-class" for a function or business process.

Revise Compensation, Appraisal and Recognition Systems

As TQM companies revise their measurement systems, they also revise their compensation, appraisal, and recognition systems to reflect the emphasis on quality.

Launch External Initiatives with Vendors

It is important that quality management be extended beyond the firm. Some of the most significant benefits of a quality program come about when the concept is also adopted by the firm's suppliers. In general, TQM efforts should become part of the entire business system that extends from raw materials to the final customer.

Review and Revise

Quality progress is constantly reviewed by quality teams and the entire quality improvement effort should be reassessed at least annually. There is no finish line in the race for quality.

VII. MANAGEMENT PROCESSES, TOOLS AND MEASURES

Implementing quality is not easy. It requires active, unwavering leadership, firm goals, and time from the CEO. Many quality initiatives fail because top management often has other priorities. If all an enterprise has is symbolism, nothing happens.

All enterprises have general access to the same equipment, technology, financing, and people. The real difference lies in how these resources are developed and deployed. In addition to the general implementation guidelines described earlier, the following management processes, tools and measures need to be adopted by an enterprise embarking on the road to quality:

- Policy Deployment
- Quality Function Deployment
- Kaizen
- Employee Involvement
- Suppliers' Management
- Competitive Benchmarking
- Quality Training
- Reward and Recognition
- Customer Retention
- Statistical Methods.

Policy Deployment

Policy Deployment is a system for planning corporate objectives and the related means for meeting them. The Japanese quality commentators describe it as the key to the TQM system. This reflects its primary characteristic: that of providing a measurable link between a company's strategic vision and plans, and the detailed means by which each level within the company will move toward achieving its related objectives. Policy Deployment is thus the method that TQM companies use to ensure goal congruence throughout the organization.

Policy Deployment evolved as the linking or umbrella TQM system in Japan over the last decade. It followed years of quality effort that had already resulted in a process-centered business environment where the use of the Plan–Do–Check–Act cycle and statistical performance measurement was common at all levels. The Plan–Do–Check–Act process is:

- Plan for improvements
- Search for problems
- Search for causes
- Attempt corrective action
- Verify if it succeeded
- If successful, incorporate into the process
- Continue the cycle.

As a result, when Japanese companies refined their strategic planning processes to improve their long-term competitive advantage, they had the considerable advantage of already knowing their business process capability. They were already able to "manage by fact" on a day-to-day basis. As a result, Policy Deployment offered Japanese companies two major business benefits. The first was a method of developing strategic plans that were not only customer-centered, but incorporated detailed means and related measures for implementing the plans over the plan period. The second was a method of focusing each organizational level on common, vital business objectives and testing the capability of the business entities to achieve the required performance.

Policy Deployment is deliberate, time consuming and, at times, difficult. It requires organizational discipline to be sustained in the face of day-to-day pressures. However, there is a greatly improved chance for TQM by using Policy Deployment (see Exhibit 4).

Quality Function Deployment (QFD)

QFD is a means of ensuring that customer requirements are accurately translated into relevant design requirements throughout each stage of the product development process. This means that the ends and means are linked at each stage. The process, like Policy Deployment, is simple but very detailed and disciplined. The rewards of QFD are well worth the extra up-front effort in planning. Toyota reports that, with QFD, its design cycle was reduced by one-third and the customer requirements were better reflected in the end product.

Kaizen

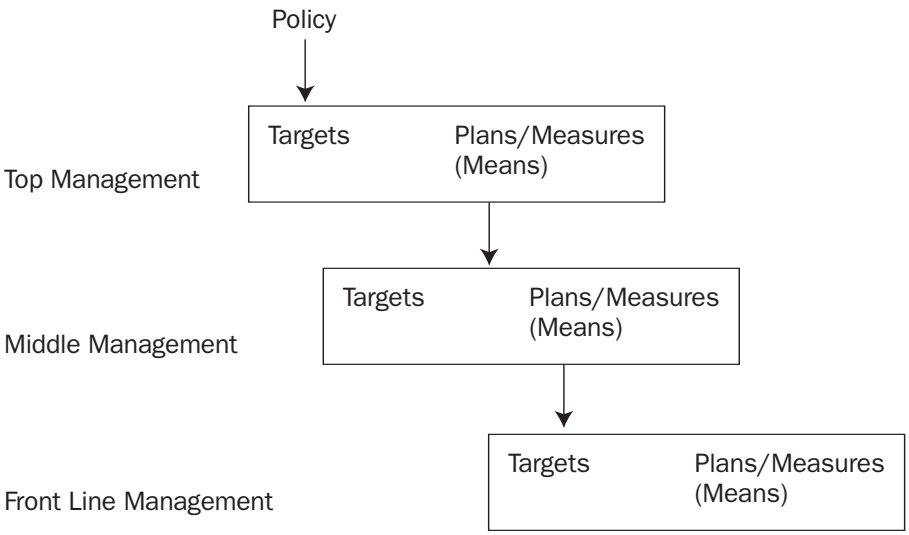
This is a Japanese term for Continuous Improvement in all aspects of a company's operations at every level. The process is often thought of as a staircase of improvement. As you move from step to step, you follow an improvement, maintain the improvement, follow an improvement, maintain an improvement, etc. Each step is a small upward movement (the vertical part of the step). While the steps are small, the staircase continues to move you upwards.

Employee Involvement (EI)

There is little chance that a firm's customers will be excited about its products and services if its workers are not. EI results in excited and committed workers. EI is more than simply organizing a few quality control circles or worker teams. Teams are only part of the picture. The creative energies of all employees must be used for problem solving and continuous improvement. This means that employees must be trained in new skills and encouraged to apply them on the job. Eventually, the number of ideas generated and the percentage of these ideas implemented become important measures of both individual and team performance.

As the EI process is absorbed, many of the roles, responsibilities, and activities of departments and individuals begin to overlap. The organization will de-layer and decompress. Responsibility for judgments, decisions, and problem resolutions will shift downward to those closest to the point of activity.

EXHIBIT 4. POLICY DEPLOYMENT



Suppliers' Management

A supplier is an extension of a company's own process. An enterprise's ability to serve its customers and to create a perception of value depends on the suppliers' ability to serve the enterprise's needs. Building a quality supplier base requires:

- reducing the supplier base to reduce variation and to increase supplier commitment and the efficient use of a buyer's resources;
- selecting suppliers not only on price but on their capability to improve quality, cost, delivery, flexibility, and their willingness to become world class;
- forming new and long-term relationships with suppliers as working partners; and
- specifying precise customer and supplier expectations and agreeing to their consistent delivery.

Competitive Benchmarking (CB)

Most organizations do not really know who or what is best in their industry. Consequently, most quality improvement targets are set internally based upon past performance. This results in conservative estimates of further expected improvements. CB is the creative tool that enables enterprises to break free of these self-imposed limits and focus on the competitors and how to exceed their performance.

CB is the continuous process of measuring an enterprise's products, services, and practices against its toughest competitors. Benchmarks should include a measure of the results as well as an analysis and the appropriate measures of the process used to achieve those results. Common benchmarks used are: cost, staffing, yield, cycle time, on-time, inventory level, and rework.

Of all the benchmarks, the most important may be customer satisfaction. Quality is only as good as the customer says it is, not what the numbers on the quality control chart show. In fact, customer satisfaction shows up as the most important criterion of the U.S. Malcolm Baidrige Quality Award.

CB emerged as a management tool with Xerox in 1979. Several other corporations such as IBM, General Motors and Motorola - all Malcolm Baldrige Quality Award winners in the United States—have since adopted it. It helps facilitate a culture that values continuous improvement, increases sensitivity to changes in the external environment, and prioritizes the areas to be worked on first.

To make CB easier, several best practices data bases are being developed. One of these is the Ernst & Young and the American Quality Foundation data base. This is based upon a study of 500 companies in the automotive, banking, computer, and health care industries in four countries.

Quality Training

An important development tool is quality training. All employees must be familiar with the tools for preventing, detecting, and eliminating non-quality.

The education process needs to be customized for the various audiences: executives, middle managers, supervisors, and workers. A suggested quality education matrix for these target audiences is provided in Exhibit 5.

Reward & Recognition

Reward and Recognition are the best means of illustrating the emphasis on TQM. Recognition can range from public acknowledgement of team accomplishments to rewards such as mugs, jackets, or monetary bonuses. Rewards should be group-oriented rather than individual. For example, “TQM DAY” would involve all employees and would be used to mark a major milestone in the company’s effort to attain Total Quality. “TQM Improvement Team of the Week” would honor a group effort.

A Reward and Recognition structure based upon quality measures can be a very powerful stimulus to promote TQM in a company.

Customer Retention

Progressive service companies use an integrated measure of service quality (i.e., customer retention). This is the yardstick that all service companies need to measure their quality. In most industries, boosting customer retention can have the same effect on profits as cutting costs by 10%. Loyal customers spend more, refer new clients, and are less costly to do business with.

Organizations must make it easy for customers to respond to both what is right and what is wrong. The response must address issues key to the quality of product or service delivery.

Some customers will complain that the company’s product or service does not meet their expectations. But many find it too easy to simply go somewhere else the next time. It is these customers that the firm must address.

As well, customers rarely make the effort to say “yes, you gave me exactly what I wanted.” This is fair; they should not have to. But the feedback system should actively pursue this information so that the organization knows it is proceeding in the right direction.

EXHIBIT 5. QUALITY EDUCATION MATRIX

	Executives	Middle Managers	Supervisors	Workers
Quality improvement overview	X	X	X	X
Employee involvement	X	X	X	X
Leadership/facilitator workshop	X	X	X	
Team building	X	X	X	X
Creative thinking	X	X	X	X
Problem solving — basic	X	X	X	X
Problem solving — advanced	X	X	X	X
Statistical Process Control			X	X
Problem solving — train the trainer	X	X	X	
Design of experiments		X	X	X
Total quality control audit	X	X		
Competitive benchmarking	X	X		
Statistical thinking (how to understand variability and the correct approach to reducing it)	X	X	X	X
Quality function deployment	X	X	X	
Total productive maintenance	X	X	X	X
General business prespective			X	X
Parameter design using Taguchi methods		X		
Policy deployment	X	X	X	

Statistical Methods

Organizations should have the ability to apply statistical concepts and methods if they intend to implement quality improvement programs. Useful statistical concepts for implementing TQM are described in Appendix 2.

VIII. TQM IMPLEMENTATION EXAMPLE

In a manufacturing setting, the following is a summary of the approach used by Motorola, a winner of the U.S. Malcolm Baldrige Quality Award, to implement TQM. This approach is similar to the eleven-point TQM implementation process discussed earlier.

The Company was a successful multinational in the 1960s and 1970s. It had such a stranglehold on the market that it hardly paid attention when Japanese competitors first entered the marketplace in the late 1970s. It had grown up to be a bureaucratic company in which one function battled another and operating people constantly bickered with corporate staff. Disputes over issues as minor as the color scheme of products had to be resolved by the CEO. The result was painfully slow product development, high manufacturing costs, and unhappy customers.

The Japanese exploited this weakness with aggressive pricing and proceeded to gain a sizable market share. By the early 1980s, the company recognized that it had to evolve rapidly into a world-class organization if it was to survive.

The company began by assessing its corporate strengths and weaknesses as well as those of its competitors. An important management step was taken in the early '80s when the company initiated a formal benchmarking process to identify the successful practices of top competitors.

The competitive benchmarking revealed that, to compete successfully, the company had to be driven by its customers and competitors. It instituted several changes in organizational structure, product development processes, and supplier relations. It also set out on a quest for quality.

The quality practices and results were studied at leading-edge U.S. and Japanese corporations. The study convinced management that the effort had to appear more lasting and convincing than mere symbolism. A high-level quality council, staffed by senior executives, was created for a period of a year to study the quality gap, competitive practices, and to recommend company-specific quality vision, goals, and action plans.

The quality council recommended the following:

- TQM needs to be a strategic imperative.
- TQM means meeting market and customer requirements.
- The quality responsibility lies with everyone, with top management exercising strong leadership.
- The quality journey would take approximately three years. The implementation steps included: extensive training, reengineering of work processes, employee involvement, quality audits, gap analysis, quality teams, measurement systems, and reward structure. Some of these were to be extended to the vendors as well.
- To support the three-year implementation process, a small quality staff needed to be established. It would coordinate and track the quality improvement process, provide technical guidance and oversee the improvement teams, develop the content of quality training, and assist professional trainers.

These recommendations were accepted. Over the following two years, the company invested considerably in quality training — particularly in Employee Involvement, Team Building, Problem Solving, Design of Experiments, Statistical Analysis, Quality Function Deployment, and Policy Deployment. The training began with the CEO and his staff and cascaded in groups across the company and its suppliers.

The above training and accompanying work process changes began to transform the company. Within three years the quality and cost competitive gaps were reduced by more than 50%. Encouraged by this progress, the company set an even more aggressive goal — to apply for and win the U.S. National Quality Award in the following three years. This required further intensive TQM efforts. At the end of the period, the company had increased its customer satisfaction index by 50%, reduced costs by an additional 20%, improved product quality, as measured by the customers, by 50%, and had begun to win back market share from competitors. These results, and the quality journey that had made them possible, were recognized by the U.S. Department of Commerce which awarded the company the National Quality Award.

IX. COST OF QUALITY

Converting the language of quality into something that management is familiar with, such as dollars, gives everyone a common language and also facilitates measuring, tracking and analyzing. Dr. Juran first proposed the concept in the *Quality Control Handbook* published in 1951 and it has been greatly refined since.

The Cost of Quality is a measure of what an organization is spending for its overall quality. It can be viewed as the difference between the actual cost of making and selling products and services and the cost if there were no failures of the products and services during manufacture or use.

Unfortunately, the term "Cost of Quality" can leave a negative impression that reflects the thinking of the 1960s when it was believed that better quality products cost more to produce. But Cost of Quality can provide a very useful tool to change the way the enterprise thinks about errors.

Examples include:

- getting management attention by taking quality out of the abstract and into dollar terms, thereby competing with other cost and scheduling priorities
- changing the way employees think about errors
- identifying and prioritizing areas for corrective actions
- measuring the effect of corrective actions and changes
- providing new emphasis on doing the job right the first time, every time.

The Cost of Quality has two basic components:

A) Cost of conformance, i.e.,
- cost of prevention
- cost of appraisal

B) Cost of non-conformance or failures, i.e.,
- cost of internal failure
- cost of external failure or lost opportunity.

Leading companies supplement these Cost of Quality measures with other non-financial measures depending upon the nature of the enterprise. Examples of additional quality measures are illustrated in Appendix 3.

Most enterprises accept that poor quality is costing them a great deal of money, but they are shocked when they find out how much. In the 1980s, the cost of poor quality was estimated to be 10 to 20% of sales dollars or two to four times the profit for an average company.

Cost of Prevention

The cost of prevention is the cost to ensure that customer requirements are met. It is associated with maintaining quality systems, such as quality control systems. These are incurred prior to or during production to prevent defective units of output.

This is a necessary cost for error prevention. By far the best way an enterprise can spend its Cost of Quality dollars is to invest in preventive actions. Unfortunately, many companies have neglected this valuable investment because of difficulties in identifying the downstream returns.

Examples of preventive actions include:

- quality planning
- quality engineering
- training to improve quality
- maintenance and calibration of production and inspection of equipment
- supplier assurance.

Cost of Appraisal

The cost of appraisal is the cost to ensure the work processes are producing outputs that meet customer needs or requirements, such as the inspection of raw materials. Here the term refers to both internal and external customers. These are incurred after production, but before sales, to identify defective items.

Examples include:
- quality data acquisition and analysis
- quality measurement criteria
- quality audits
- laboratory acceptance testing
- field evaluation and testing
- inspection and testing
- raw materials testing
- in-process testing
- review of test and inspection data.

Unlike preventive actions, appraisal actions do not reduce the number of errors; they only detect a higher percentage of errors in output before it is delivered to the customer.

Cost of Internal Failure

These are costs of not meeting customer requirements, such as the cost of having to do work again (rework). These are easy to identify because many accounting systems already track them. They are incurred to fix or dispose of the defective items before they are sold.

Unlike the cost of prevention and appraisal, these costs are not value added and *never necessary.*

Examples include:
- scrap
- rework or repair
- trouble shooting
- re-inspect and re-test.

Cost of External Failure or Lost Opportunity

These costs represent the lost profits associated with not meeting external customer needs or requirements. If the external customers become dissatisfied with an enterprise's offerings, they are likely to return the product, not buy from the firm again and, more importantly, tell other potential customers about their experience. The cost of lost opportunity, therefore, includes lost profits from order cancellations and market share loss.

Examples include:
- customer service faults
- products or services rejected and returned
- products or services recalled for modification
- repairs and replacements or added service provided under warranty
- admitted repairs beyond warranty
- product liability
- customer losses due to poor quality.

X. COST OF QUALITY IN SERVICE INDUSTRIES

Costing quality in service industries is similar to costing quality in manufacturing. External failures, however, are a more important quality cost in service industries. Errors in service are not amenable to rework. In manufacturing industries, customers can call and demand warranty repairs on a faulty product. In the service industry, it does not always work that way. The service failure can result in the company's losing the customer—even without knowing it.

For example, an airline that is either tardy or has poor in-flight service may not win the loyalty of frequent business travelers and thereby will lose market share.

Management accountants should be aware that a service company's profit has more to do with customer defections than with unit costs, economy of scale, and other factors traditionally tracked by cost accounting. For example, in some industries, companies can boost profits by 50% just by retaining 10% more of their customers.

The cost of lost opportunity in a service industry, therefore, needs to be strengthened to include the probability of market damage done by poor service.

Another major difference between service industries and manufacturing is that labor costs take up a far greater proportion of operating costs. This can lead to several challenges. For example, time cannot be reworked or reclaimed. In a manufacturing organization, raw material can be reclaimed. But when the material is people's time it cannot. This means that, by looking at the percentage of time spent on various activities, Cost of Quality data may equate a reduction in failure costs with job losses, and cooperation may diminish.

XI. QUALITY COST RELATIONSHIPS

Since prevention and appraisal costs are a function of managerial discretion, they are referred to as voluntary costs. Management makes direct decisions about the current funds to be budgeted for these voluntary costs. In contrast, investments to manage non-conformance or failure costs may not be directly controllable by management. For example, the cost of customer dissatisfaction, while not easily measurable, may trigger a cost for management to contain.

Even though non-conformance costs may not be directly controllable, they are definitely related to voluntary costs. When additional resources are allocated for prevention and appraisal activities, quality improves and non-conformance costs tend to decline. Conversely, when quality conformance efforts are reduced across the supplier, manufacturer and distribution chain, non-conformance costs increase. Accordingly, voluntary costs and failure costs move in the opposite direction.

Therefore, the minimum amount of total quality cost is located at the point where the marginal voluntary expenditures are equal to the marginal savings on non-conformance costs (see Exhibit 6).

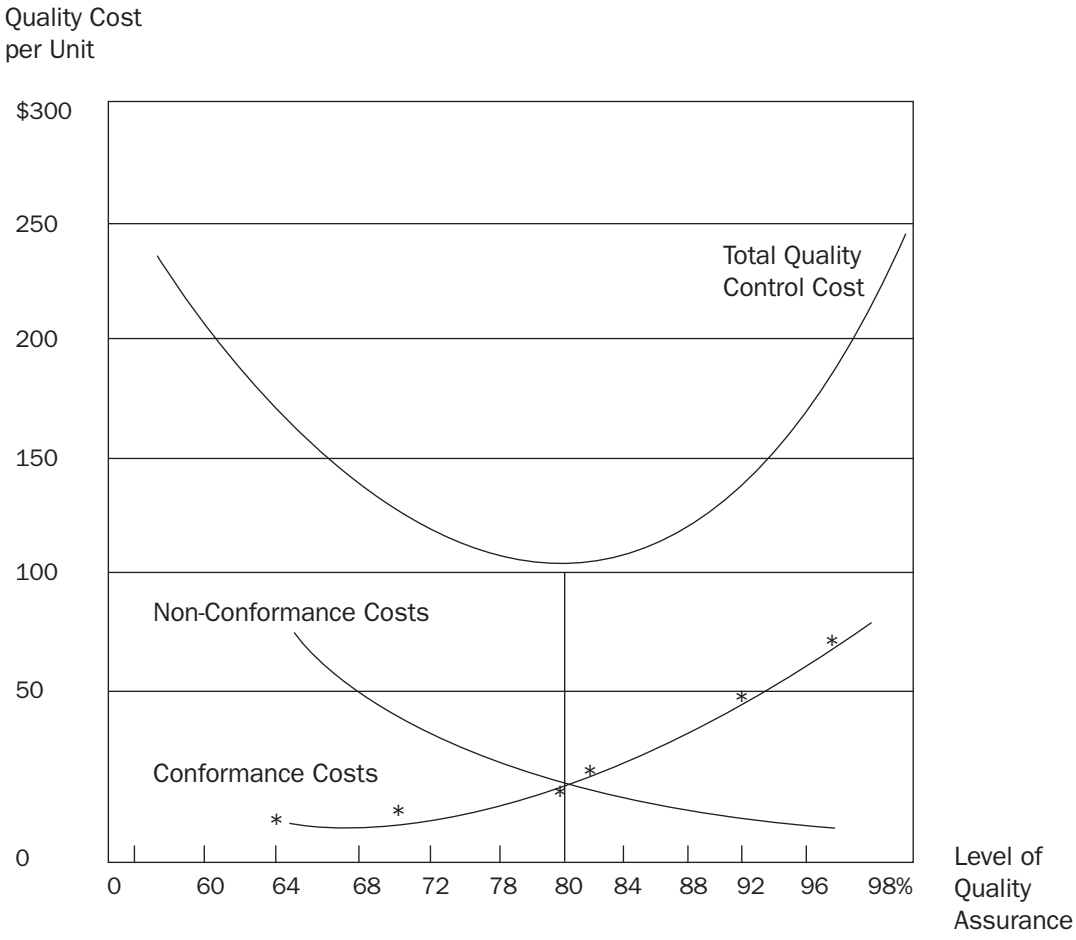
From Exhibit 6, it is clear that the minimum total quality cost per unit is located at a level of quality assurance that is less than 100%. At very low levels of assurance, significant internal and external failure costs outweigh any cost savings that could be attained by avoiding voluntary costs. In contrast, extremely high levels of quality assurance result in voluntary cost expenditures that cannot be offset by non-conformance cost savings.

For an organization not steeped in TQM, the costs of internal failures and lost opportunities will comprise the biggest part of the total Cost of Quality. As these non-conformance costs are identified and managed, the relative balance between conformance and non-conformance costs shifts. In a steady state, both the conformance and non-conformance costs decline, though as a percentage of total Cost of Quality, the conformance costs increase as shown in Exhibit 7.

XII. MANAGEMENT ACCOUNTING CHALLENGES

Management accountants require a clear understanding of TQM methodology. They should also be able to create a system of quality information measurement and to evaluate exactly what is

EXHIBIT 6. OPTIMAL QUALITY COST



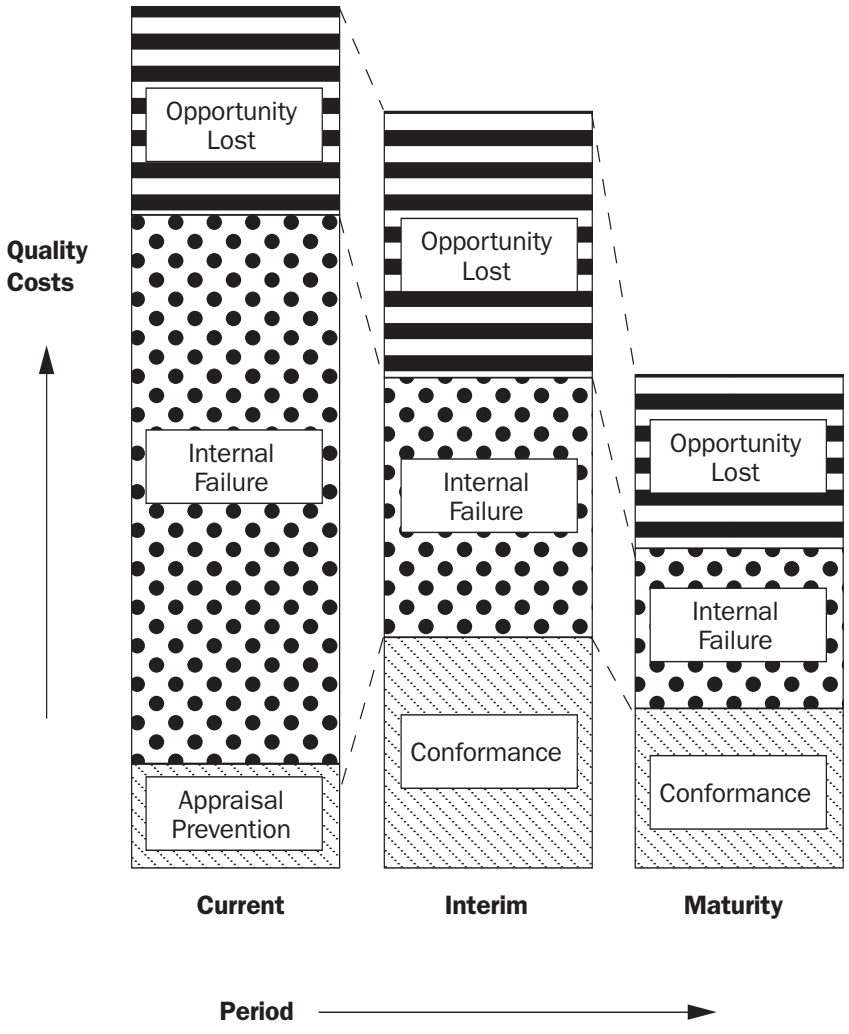
required by each organizational unit and by the total enterprise.

The management accountant may need to extensively rewrite existing product costing and reporting systems. The costs associated with lost opportunities or loss of market prominence as quality falls below customer expectations may require more subjective reasoning than normal. These costs may have to be subjectively estimated before managers have an idea of their total quality costs.

Most accounting systems don't reflect all the specific quality cost categories that are required for quality management purposes. The management accountant, therefore, must:

- determine which accounts contain valid information for TQM;

EXHIBIT 7. COST OF QUALITY PROPORTIONS



- reorganize and restructure the existing accounting system to provide accurate quality cost data; and
- revise the chart of accounts to reflect each quality cost category.

Another shortcoming of most accounting systems is their failure to associate costs with activities. The systems do not provide individual managers and employees with the information they require to make improvements. Therefore, quality teams will not have the information necessary to focus on the most important quality problems.

The management accountant needs to relate quality costs to activities to help quality improve-

ment teams focus their efforts appropriately in order to assure the success of the TQM effort.

The solution lies in applying techniques from activity-based costing to TQM. Activity-based costing yields improved information because of its use of an extensive cost driver identification process to relate activities to products or services.

Cost drivers (such as the number of different parts used or the effort expended by a product) reflect the consumption activities of a product or service. Examples of activities include:

- Tapping threads in a hole in a metal part
- Issuing a purchase order.

Cost drivers allow quality teams to pinpoint activities which are the result of not doing things the right way.

Since no standard format has been developed for Cost of Quality reporting, the types of items included vary within and among companies. For example, some Cost of Quality reports include overhead related to internal failure costs while others do not. These differences make it difficult to compare the performance of organizational units. If managers are to be evaluated on the quality cost performance of their units, the management accountant should ensure that the Cost of Quality reports are standardized.

In addition to these challenges, the management accountant must recognize that the quality cost performance measures will vary widely depending upon the organization. Nevertheless, he or she should ensure that the measurement and reporting process meets the following criteria:

- directly relates to the requirements of the internal customer using these measures and reports;
- uses Cost of Quality measures as well as other non-financial measures;
- uses measures that vary between locations depending upon quality and business challenges;
- uses measures that change over time as the needs change;
- is simple and easy to use, implement and monitor;
- provides fast feedback to users and managers;
- is intended to foster improvement rather than just to monitor;
- motivates people to achieve quality gains.

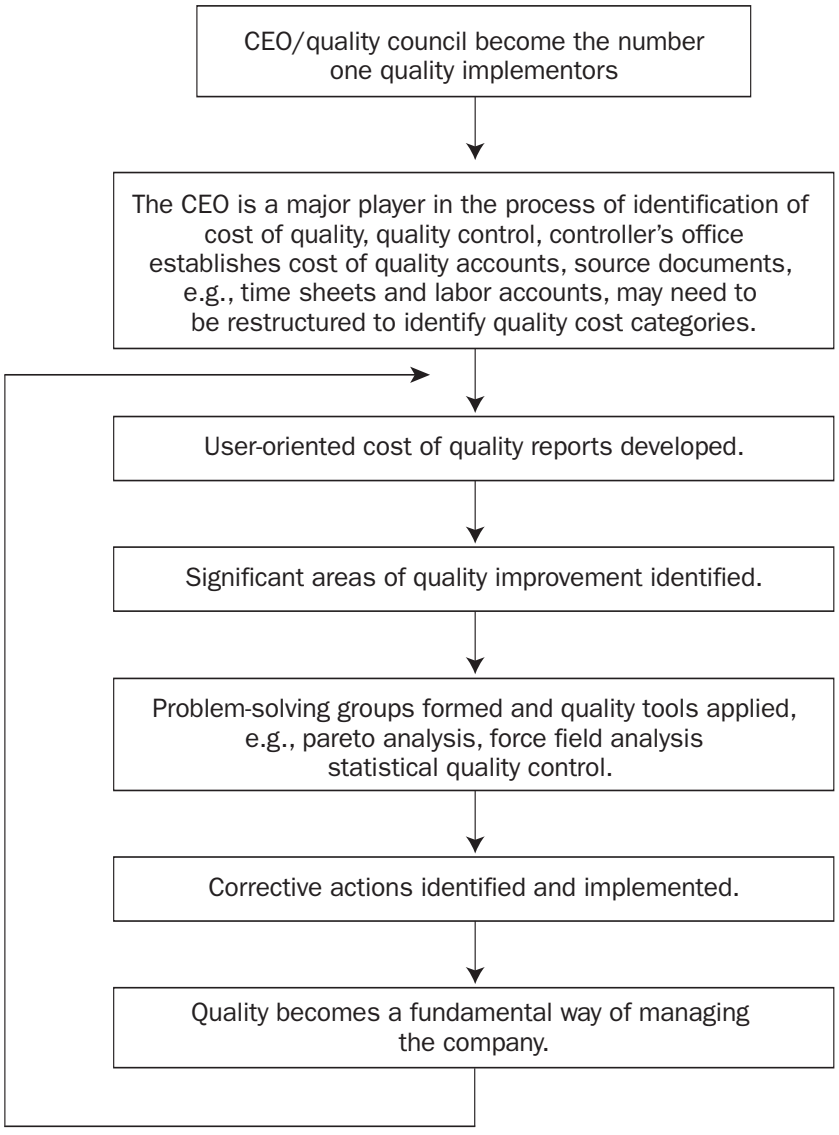
Management accountants will need to be aware that, although Cost of Quality data can be an attention-getter for senior management, precision measurement may be redundant. Arguments can arise over the correct classification of costs. If the Cost of Quality runs as high as 20% of revenue, greater precision in calculating cost seems to be of little value and perhaps very expensive to achieve. Therefore, techniques such as periodic audits of Cost of Quality may suffice if the accounting system changes prescribed earlier are prohibitively expensive. The primary benefits of the Cost of Quality are its initial shock value and its function as a means to measure improvement over time.

Based upon these challenges, a proposed summary of the quality cost process is described in Exhibit 8.

SUMMARY AND CONCLUSIONS

Examining the Cost of Quality allows the enterprise to identify, prioritize and monitor quality improvements. Other measures and processes (such as statistical analysis, Quality Function Deployment, Policy Deployment, quality circles and benchmarking) will also be required.

EXHIBIT 8. QUALITY COST PROCESS SUMMARY



The leadership for a company-wide quality transition has to start at the top. It cannot be delegated. The companies that have successfully moved to the quality paradigm established an executive-level quality council to oversee and propel the change process. The council must be chaired by the CEO or the president and composed of the top management team.

The management accountant has the skills required to be a valuable contributor to the executive quality council, advising on quality opportunity areas and the measures and reports required to monitor progress.

The journey on this quality path is difficult. It can take several years to make significant progress. Several behavioral factors common to large organizations can become inhibitors. For example, some functions may be identified as contributing to the Cost of Quality. The managers of these functions may not cooperate. There may also be debates about what should be considered as opportunities for managing the Cost of Quality. Finally, change at one step of the production process may cause unexpected or hidden changes in subsequent processes.

A company that has successfully implemented TQM can expect improved market share or profits or both. Cost reductions of 5 to 10%, out of a potential 20% of sales, are not uncommon.

Companies near the end of their transition to TQM appear very different from when they started. The differences show up, for example, in the following areas:

- the organizational structure becomes more efficient and flexible. Internal communication improves as some non-value-added or "find and fix" functions are reduced;
- internal measures of performance are replaced or supplemented by customer-oriented quality measures. Several new financial and non-financial measures (such as customer satisfaction) are added;
- all employees in all departments are introduced to the basic tools and philosophy of TQM. Decision making becomes more broadly distributed;
- there are many cross-functional improvement efforts;
- suppliers become heavily involved and "buy in" to programs related to the quality quest;
- key products/services and markets are reorganized;
- several management processes are institutionalized, such as benchmarking, continuous improvement, elimination of waste, prevention not detection, JIT, reduction of variation, statistical thinking, and consistent management practices.

While many companies can expect a successful transition, others will falter or achieve only partial benefits. They fail because they do not recognize that the total journey can take several years. Over this time there can be changes in the key players or competing management priorities. This guideline is designed to alleviate some of these pitfalls.

APPENDIX 1: CASE STUDY

It is impossible to provide a general model of quality costing for all companies.

Since a standard format for Cost of Quality reporting has yet to be developed, management accountants may not be aware of the analytical methodologies. Various types of analysis, reports and graphs can be developed once the data has been gathered, surveyed by questionnaires, or estimated by knowledgeable personnel. A case study in a manufacturing environment is described below to highlight the analytical methodologies used to identify the areas for quality improvement.

Manufacturing Example

Manufacturing company X operates in a highly competitive environment and has been experiencing increasing cost and quality pressures from new Japanese entrants. By Year 1, the external failure costs as measured by warranty claims, customer dissatisfaction, and share loss had increased to 60% of the total Cost of Quality.

Realizing this, the company instituted a corporate-wide quality program, using a three-year TQM process, to win customers back. This required considerable investments in voluntary prevention and appraisal costs.

In the first year, the company increased the voluntary prevention and appraisal costs by approximately 50%. In the second year, the investment began to pay dividends.

The management accountant gathered and summarized the quality costs in the following Cost of Quality report. The purpose of the report was to communicate to management the magnitude of the Cost of Quality and provide a baseline for measuring the impact of future improvement activities (see Exhibit 9).

The report indicated that prevention and appraisal investments had begun to pay off in Year 2. The internal failure, external failure, and total costs had all decreased.

	Increase/Decrease
• Prevention Costs	+45%
• Appraisal Costs	+55%
• Internal Failure Costs	–31%
• External Failure Costs	–47%
• Total Quality Costs	–26%

A decrease in the warranty costs resulted from a decrease in defective products delivered to customers. The market share, however, did not yet show a gain. This can be expected when a company first begins to emphasize quality. It takes time for quality to work its way through to the market share. Increased quality should show up later as the customers experience it and the company re-establishes itself.

Year 1 and 2 quality costs were further summarized (see Exhibit 10). This graph showed the magnitude of the quality costs and compared the current period's costs with the prior year's. As TQM is fully implemented by company X, total quality costs will decline. Prevention and appraisal costs, however, will increase in proportion.

The quality cost data provided by the management accountant pointed to the areas that needed quality improvement. The problem areas were addressed through quality circles and problem solving groups. Several times, further analysis of the data through statistical analysis techniques was necessary.

Rework and reject was the biggest line item in the internal failure costs. The company found it

EXHIBIT 9. COST OF QUALITY REPORT

	Year 2	Year 1	% Change
PREVENTION COSTS			
Training	$ 90,000	$ 50,000	+80
Processes/Procedures	50,000	35,000	+42
Quality Planning	86,000	65,000	+32
Other Quality Improvement Efforts	60,000	45,000	+33
Data Analysis	40,000	30,000	+33
Total	**$326,000**	**$225,000**	**+45**
APPRAISAL COSTS			
Testing	140,000	90,000	+55
Performance Measurement	75,000	50,000	+50
Supplier Monitoring	65,000	40,000	+62
Customer Surveys	30,000	20,000	+50
Total	**$310,000**	**$200,000**	**+55**
INTERNAL FAILURE COSTS			
Rework and Reject	55,000	100,000	–45
Reinspection and Testing	35,000	40,000	–13
Equipment Failure	30,000	35,000	–14
Other Failures	20,000	30,000	–33
Total	**$140,000**	**$205,000**	**–31**
EXTERNAL FAILURE COSTS			
Warranty	70,000	200,000	–65
Cost of Warranty	100,000	120,000	–16
Customer Losses (estimated)	600,000	1,140,000	–47
Total	**$ 770,000**	**$1,460,000**	**–47**
TOTAL QUALITY COSTS	**$1,546,000**	**$2,090,000**	**–26**

necessary to break it down by product. One of the most powerful analytical tools is Pareto Analysis. This technique was used to identify the products requiring further root cause analysis. Exhibit 11 showed that three product lines out of fourteen accounted for 70% of the total scrap.

Further root cause analysis explained that the parts on these three product lines were scrapped because of the overall sub-system tolerance requirements. With this information, management investigated the reasons for the low part tolerance parameters and formulated a plan to correct the situation.

EXHIBIT 10. COST OF QUALITY GRAPH

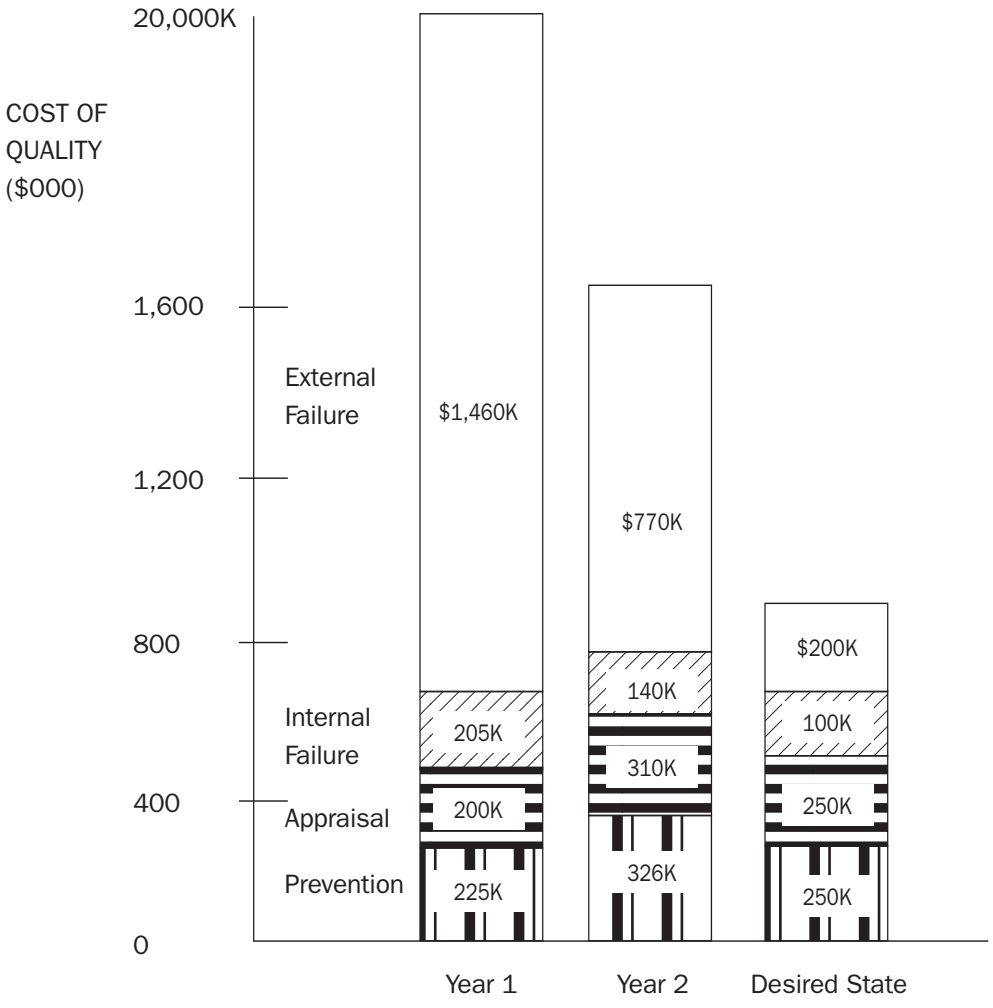
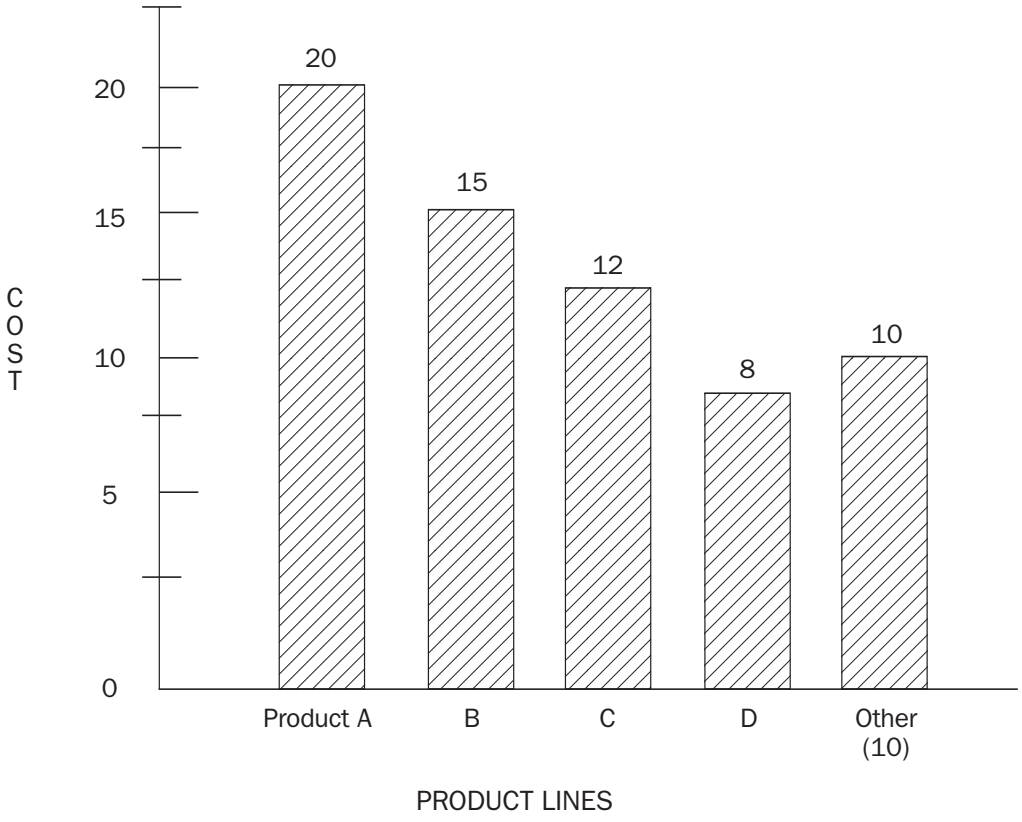


EXHIBIT 11. REWORK AND REJECT COSTS BY PRODUCT ANALYSIS



APPENDIX 2: STATISTICAL TOOLS AND PROCESSES MEASURES

Traditional accounting systems do not provide sufficient information to personnel responsible for observing the production process, charting quality performance, or identifying special causes of variation.

Management accountants need to understand the use of statistical tools and processes measures so that they can actively participate in and contribute to the TQM process. A sample listing is presented below.

Closed loop

In a closed loop process, feedback provides information about the process output. When this information shows the need for correction, the process output is corrected automatically. A closed loop can be effective in reducing variability and centering a process if the process feedback is correctly analyzed and if process adjustments are appropriate.

Errors

The result of failing to correctly perform an action. Errors result in non-conforming outputs if left uncorrected.

Error Reduction

The reduction of errors, measured in terms of error rate. Improvement efforts should be directed to reducing errors rather than correcting non-conforming outputs.

Non-random Variations

A term referring to variation in a process output, sometimes used in analyzing control charts. This variation is the result of "special" causes and can often be improved by the employees (supported by their managers) who use the process being measured. Usually these variations show up on control charts as points outside the control limits, or as trends, shifts or periodic changes.

Process Capability Measurement

A measurement to determine if a process can produce output that is both centered on the target and well within the specifications limits. A process is "capable" if it fully conforms to customer requirements; meets predetermined levels of centering on the target value and variability within the specifications limits; and is in control.

Process Quality Assurance

A system that verifies that the process is being followed, that the enablers for the process are in place, and that the process is consistently capable of achieving specified outputs.

Random Variation

A term referring to inevitable variation in a process output, sometimes used in analyzing control charts. Random variation is usually the result of "common" causes that can often be improved only by management (in contrast to "special" causes that the employee using the process may often address). While the causes may appear to have a small effect, a single cause may substantially influence the size of the variation.

Six Sigma Quality

Sigma is a measure of variation in a product or process. It is a symbol for a statistical parameter known as standard deviation. In a typical process, X represents the process average and sigma its standard deviation. Generally, the process width is defined as X ± 3 sigma. If the specification width was the same, the process used to be considered in control. But in real terms, such a process would have a defect rate of 0.27 percent or 2,700 defects per million units. If, however, the process width is halved and the specification width remained the same, the latter's boundaries would be at X ±6 sigma. In such a case, the defect rate would be only 2 defects per million units. And even if the process

average shifted by 1.5 sigma to one side, the defect rate would only be 3.4 defects per million units. This is the statistical meaning of ±6 sigma.

In product terms, Motorola's goal is for every important parameter to be designed, built, and brought to ±6 sigma; that is, the process width would be no more than half the specification width. In administrative terms, ±6 sigma is simply perfection; that is, having a defect rate of no more than 3.4 errors per one million opportunities for error. Motorola is dedicated to achieving this state of perfection by 1992.[1]

Standardization
This ensures the consistent use of a process or procedure across all applicable areas. After a process improvement has been tested and verified, the improved process must be standardized to maintain the benefit across the corporation.

Statistical Process Control (SPC)
The application of statistical techniques for measuring and analyzing the variation in processes.

Statistical Quality Control (SQC)
The application of statistical techniques for measuring and improving the quality of processes. SQC includes SPC, diagnostic tools, sampling plans, and other statistical techniques.

Statistical Tools
Graphical and/or numerical methods that assist in the analysis of a process or population of events. Often the tools use a sampling of the population to make a judgment and decision about the entire population.

Listed below are the seven most commonly used statistical tools for analytical problem solving.

1. Check Sheets
2. Cause and Effect Diagrams
3. Histograms
4. Pareto Diagrams
5. Control Charts
6. Scatter Diagrams
7. Graphs.

Stratification
The process of classifying data into two or more sub-groups based on categories or characteristics. This is a powerful and frequently used tool. When the data are stratified according to the variables, which are thought to cause variation, the causes of variation can be detected more easily.

10X Improvement
(Also known as "tenfold reduction".) lOX improvement means reducing the process's error or non-conforming output rate to 10% of its existing rate. Improvement is measured by examining on-going quality in terms of error and non-conforming output rates.

Variability
The inevitable changes in the measured values of a process output. Changes are due to random causes (natural or common causes) or non-random causes (special causes). Variability can be measured. It describes the spread of the measured output values around the average. Sigma (standard deviation) is an often used numerical measure of variability. Variation can be visually represented through the use of graphical techniques.

Variability Reduction
The process of reducing the spread of values of a process output. To reduce variability, you separate the random from the non-random variation before you develop corrective action plans. You then use different corrective actions for the random and non-random causes.

1 Bhote, K.R. Motorola's Long March to the Malcolm Baldrige National Quality Award. *National Productivity Review.* Vol. 8 (Autumn 1989).

APPENDIX 3: ADDITIONAL QUALITY MEASURES

Cost of Quality by itself cannot resolve quality problems. It is only designed to help management understand the magnitude of the problem, identify opportunities, and measure progress. It must be accompanied by an effective improvement process to reduce the errors in an enterprise. An enterprise should supplement the Cost of Quality measures with additional measures to maintain focus on unique quality elements. The management accountant must achieve a working knowledge of these measures to help quantify the Cost of Quality.

Some of these measures are common to most organizations. Others may be unique to the nature of an enterprise, i.e., industry, competition, current and desired state of quality, etc.

An exhaustive list of quality measures for manufacturing and service industries is impossible to create. Many of these measures have to be developed specifically for the industry, company or quality need. A sample listing is presented below.

- Installation failures
- Scrap and rework
- Reinspection and retest
- Redesign and engineering changes
- Soft toolings
- Abandoned programs
- Billing errors
- Bad debts
- Premium shipping costs
- Supplier cancellation costs
- Overdue accounts receivable
- Off-spec/waivers
- Excess inventory

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