

EVOLUTION OF TOTAL QUALITY MANAGEMENT

Total quality Management (TQM) is defined as both as philosophy and a set of guiding principles that represent the foundation of a continuously improving organization.

Basic Approach TQM requires six basic concepts:

1. A commitment and involved management to provide long-term top-to-bottom organizational support.
2. An unwavering focuses on the customer, both internally and externally.
3. Effective involvement and utilization of the entire work force.
4. Continuous improvement of the business and production process.
5. Treating suppliers as partners.
6. Establish performance measures such as uptime, percent nonconforming, absenteeism and customer satisfaction should be determined for the process. Quantitative data are necessary to measure the continuous quality improvement activity [1].

Table 1

GURUS OF TQM:

Shewhart	Control chart theory PDCA Cycle
Deming	Statistical Process Control
Juran	Concepts of Shewhart Return on Investmen
Feiganbau m	Total Quality Control Management involvement Employee involvement Company wide quality control
Ishikawa	Cause and Effect diagram Quality circle concept
Crosby	Quality is Free Conformance to requirement
Taguchi	Loss function concept Design of Experiments

Figure 1. Benefits to TQM

A quality management system is a management technique used to communicate to employees what is required to produce the desired quality of products and services and to influence employee actions to complete tasks according to the quality specifications [1].

Figure 2. Purpose of quality management

The concept of quality has existed for many years, though its meaning has changed and evolved over time. In the early twentieth century, quality management meant inspecting products to ensure that they met specifications. In the 1940s, during World War II, quality became more statistical in nature. Statistical sampling techniques were used to evaluate quality, and quality control charts were used to monitor the production process. In the 1960s, with the help of so-called “quality gurus,” the concept took on a broader meaning. Quality began to be viewed as something that encompassed the entire organization, not only the production process. Since all functions were responsible for product quality and all shared the costs of poor quality, quality was seen as a concept that affected the entire organization. The meaning of quality for businesses changed dramatically in the late 1970s. Before then quality was still viewed as something that needed to be inspected and corrected. However, in the 1970s and 1980s many U.S. industries lost market share to foreign competition. In the auto industry, manufacturers such as Toyota and Honda became major players. In the consumer goods market, companies such as Toshiba and Sony led the way. These foreign competitors were producing lower-priced products with considerably higher quality. To survive, companies had to make major changes in their quality programs. Many hired consultants and instituted quality training programs for their employees. A new concept of quality was emerging. One result is that quality began to have a strategic meaning. Today, successful companies understand that quality provides a competitive advantage. They put the customer first and define quality as meeting or exceeding customer expectations. Since the 1970s, competition based on quality has grown in importance and has generated tremendous interest, concern, and enthusiasm. Companies in every line of business are focusing on improving quality in order to be more competitive. In many industries quality excellence has become a standard for doing business. Companies that do not meet this standard simply will not survive. As you will see later in the chapter, the importance of quality is demonstrated by national quality awards and quality certifications that are coveted by businesses. The term used for today’s new concept of quality is total quality management or TQM. Table 1[1-10] presents a timeline of the old and new concepts of quality. You can see that the old concept is reactive, designed to correct quality problems after they occur. The new concept is proactive, designed to build quality into the product and process design. Next, we look at the individuals who have shaped our understanding of quality [1].

To fully understand the TQM movement, we need to look at the philosophies of notable individuals who have shaped the evolution of TQM. Their philosophies and teachings have contributed to our knowledge and understanding of quality today. Their individual contributions are summarized in Table 2.

Table 2

Time	Focus	
Early 1900s	Inspection	Old Concept of Quality: Inspect for quality after production.
1940s	Statistical sampling	
1960s	Organizational quality focus	
1980s and Beyond	Customer driven quality	New Concept of Quality: Build quality into the process. Identify and correct causes of quality problems.

Walter A. Shewhart was a statistician at Bell Labs during the 1920s and 1930s. Shewhart studied randomness and recognized that variability existed in all manufacturing processes. He developed quality control charts that are used to identify whether the variability in the process is random or due to an assignable cause, such as poor workers or miscalibrated machinery. He stressed that eliminating variability improves quality. His work created the foundation for today's statistical process control, and he is often referred to as the "grandfather of quality control" [6].

W. Edwards Deming is often referred to as the "father of quality control." He was a statistics professor at New York University in the 1940s. After World War II he assisted many Japanese companies in improving quality. The Japanese regarded him so highly that in 1951 they established the Deming Prize, an annual award given to firms that demonstrate outstanding quality. It was almost 30 years later that American businesses began adopting Deming's philosophy. A number of elements of Deming's philosophy depart from traditional notions of quality [3].

Table 3

Quality Guru	Main Contribution
Walter A. Shewhart	–Contributed to understanding of process variability. –Developed concept of statistical control charts.
W. Edwards Deming	–Stressed management's responsibility for quality. –Developed "14 Points" to guide companies in quality improvement.
Joseph M. Juran	–Defined quality as "fitness for use." –Developed concept of cost of quality.
Armand V. Feigenbaum	–Introduced concept of total quality control.
Philip B. Crosby	–Coined phrase "quality is free." –Introduced concept of zero defects.
Kaoru Ishikawa	–Developed cause-and-effect diagrams. –Identified concept of "internal customer."
Genichi Taguchi	–Focused on product design quality. –Developed Taguchi loss

The first is the role management should play in a company's quality improvement effort [1-10]. Historically, poor quality was blamed on workers — on their lack of productivity, laziness, or carelessness. However, Deming pointed out that only 15 percent of quality problems are actually due to worker error. The remaining 85 percent are caused by processes and systems, including poor management. Deming said that it is up to management to correct system problems and create an environment that promotes quality and enables workers to achieve their full potential. He believed that managers should drive out any fear employees have of identifying quality problems, and that numerical quotas should be eliminated. Proper methods should be taught, and detecting and eliminating poor quality should be everyone's responsibility. Deming outlined his philosophy on quality in his famous "14 Points." These points are principles that help guide companies in achieving quality improvement. The principles are founded on the idea that upper management must develop a commitment to quality and provide a system to support this commitment that involves all employees and suppliers. Deming stressed that quality improvements cannot happen without organizational change that comes from upper management[3].

After W. Edwards Deming, Dr. Joseph Juran is considered to have had the greatest impact on quality management. Juran originally worked in the quality program at Western Electric. He became better known in 1951, after the publication of his book *Quality Control Handbook*. In 1954 he went to Japan to work with manufacturers and teach classes on quality. Though his philosophy is similar to Deming's, there are some differences. Whereas Deming stressed the need for an organizational "transformation," Juran believes that implementing quality initiatives should not require such a dramatic change and that quality management should be embedded in the organization. One of Juran's significant contributions is his focus on the definition of quality and the cost of quality. Juran is credited with defining quality as fitness for use rather than simply conformance to specifications. As we have learned in this chapter, defining quality as fitness for use takes into account customer intentions for use of the product, instead of only focusing on technical specifications. Juran is also credited with developing the concept of cost of quality, which allows us to measure quality in dollar terms rather than on the basis of subjective evaluations. Juran is well known for originating the idea of the quality trilogy: quality planning, quality control, and quality improvement. The first part of the trilogy, quality planning, is necessary so that companies identify their customers, product requirements, and overriding business goals. Processes should be set up to ensure that the quality standards can be met. The second part of the trilogy, quality control, stresses the regular use of statistical control methods to ensure that quality standards are met and to identify variations from the standards. The third part of the quality

trilogy is quality improvement. According to Juran, quality improvements should be continuous as well as breakthrough. Together with Deming, Juran stressed that to implement continuous improvement workers need to have training in proper methods on a regular basis [3,7].

Another quality leader is Armand V. Feigenbaum, who introduced the concept of total quality control. In his 1961 book *Total Quality Control*, he outlined his quality principles in 40 steps. Feigenbaum took a total system approach to quality. He promoted the idea of a work environment where quality developments are integrated throughout the entire organization, where management and employees have a total commitment to improve quality, and people learn from each other's successes. This philosophy was adapted by the Japanese and termed "company-wide quality control" [9].

Phillip B. Crosby is another recognized guru in the area of TQM. He worked in the area of quality for many years, first at Martin Marietta and then, in the 1970s, as the vice president for quality at ITT. He developed the phrase "Do it right the first time" and the notion of zero defects, arguing that no amount of defects should be considered acceptable. He scorned the idea that a small number of defects is a normal part of the operating process because systems and workers are imperfect. Instead, he stressed the idea of prevention. To promote his concepts, Crosby wrote a book titled *Quality Is Free*, which was published in 1979. He became famous for coining the phrase "quality is free" and for pointing out the many costs of quality, which include not only the costs of wasted labor, equipment time, scrap, rework, and lost sales, but also organizational costs that are hard to quantify. Crosby stressed that efforts to improve quality more than pay for themselves because these costs are prevented. Therefore, quality is free. Like Deming and Juran, Crosby stressed the role of management in the quality improvement effort and the use of statistical control tools in measuring and monitoring quality [2,3,7].

Kaoru Ishikawa is best known for the development of quality tools called cause-and-effect diagrams, also called fishbone or Ishikawa diagrams. These diagrams are used for quality problem solving, and we will look at them in detail later in the chapter. He was the first quality guru to emphasize the importance of the "internal customer," the next person in the production process. He was also one of the first to stress the importance of total company quality control, rather than just focusing on products and services. Dr. Ishikawa believed that everyone in the company needed to be united with a shared vision and a common goal. He stressed that quality initiatives should be pursued at every level of the organization and that all employees should be involved. Dr. Ishikawa was a proponent of implementation of quality circles, which are small teams of employees that volunteer to solve quality problems [10].

Dr. Genichi Taguchi is a Japanese quality expert known for his work in the area of product design. He estimates that as much as 80 percent of all defective items are caused by poor product design. Taguchi stresses that companies should focus their quality efforts on the design stage, as it is much cheaper and easier to make changes during the product design stage than later during the production process. Taguchi is known for applying a concept called design of experiment to product design. This method is an engineering approach that is based on developing robust design, a design that results in products that can perform over a wide range of conditions. Taguchi's philosophy is based on the idea that it is easier to design a product that can perform over a wide range of environmental conditions than it is to control the environmental conditions. Taguchi has also had a large impact on today's view of the costs of quality. He pointed out that the traditional view of costs of conformance to specifications is incorrect, and proposed a different way to look at these costs. Let's briefly look at Dr. Taguchi's view of quality costs. According to the traditional view of conformance to specifications, losses in terms of cost occur if the product dimensions fall outside of the specified limits. However, Dr. Taguchi noted that from the customer's view there is little difference whether a product falls just outside or just inside the control limits. He pointed out that there is a much greater difference in the quality of the product between making the target and being near the control limit. He also stated that the smaller the variation around the target, the better the quality. Based on this he proposed the following: as conformance values move away from the target, loss increases as a quadratic function. According to the function, smaller differences from the target result in smaller costs: the larger the differences, the larger the cost. The Taguchi loss function has had a significant impact in changing the view of quality cost. What characterizes TQM is the focus on identifying root causes of quality problems and correcting them at the source, as opposed to inspecting the product after it has been made. Not only does TQM encompass the entire organization, but it stresses that quality is customer driven. TQM attempts to embed quality in every aspect of the organization. It is concerned with technical aspects of quality as well as the involvement of people in quality, such as customers, company employees, and suppliers. Here we look at the specific concepts that make up the philosophy of TQM [9].

The quality movement and quality systems have had many different names or terms of reference in the past few decades, and might look like a short-lived business management trend at first glance. With everincreasing competition and consumer expectations, professionals and business managers cannot ignore quality issues and expect to maintain or improve their competitive position. Quality systems, time and again, have been responsible for substantial increases in the bottom line of businesses in every industry and have given organizations the boost they need to meet overall goals and objectives. Organizations that do not accept that quality improvement is

going to be ingrained into every part of their business are not going to be around to see what the future brings.

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