

## GURUS OF QUALITY

# Feigenbaum's Enduring Influence

by **Gregory H. Watson**

**A**rmand V. "Val" Feigenbaum is an Honorary Member of ASQ and the International Academy for Quality, is a member of the National Academy of Engineers and has three honorary doctorate degrees. Why is he so revered?

### In 50 Words Or Less

- **Armand V. Feigenbaum was the first to define a systems engineering approach to quality.**
- **Total quality control combines management methods and economic theory with organizational principles, resulting in commercial leadership.**
- **Widespread quality improvement performance in a nation's leading businesses is directly related to quality's long-term economic impact.**

Feigenbaum was one of the first engineers to learn how to speak the language of management by using financial performance as an indicator of poor quality. Over the years he has refined his business theories to demonstrate the economic relationships whereby quality drives commercial performance.

Feigenbaum's study of the macroeconomic impact of quality improvement has demonstrated a lag between the initiation of total quality improvement programs within a nation's leading companies and the observed economic effects throughout general business. For example, quality was introduced in Japan in the 1950s, but its economy didn't flower until the 1970s. Similarly, the United States began using quality in the early 1980s but didn't see economic success until the 1990s.

The commercial success of Feigenbaum's total quality control concept is undisputable when faced with its wide number of proponents throughout the global business community. Total quality control, known today as total quality management (TQM), is one of the foundations of modern management and has been widely accepted as a viable operating philosophy in all economic sectors.<sup>1</sup>

The pragmatic, economic basis established for defining total quality and the integration of previous

concepts and methods of quality control into a systematic discipline are what has made Feigenbaum's work so significant. Commercial success for many industries has resulted from the system of thinking Feigenbaum first introduced in the 1950s and enhanced over the years. He is recognized as one of the most significant thought leaders in this second generation of the science of management.<sup>2</sup>

TQM, coupled with a commercially viable product or service, has been proven an important ingredient in commercial success and may be compared to some of the more significant scientific breakthroughs in the discovery of the structure of the physical world.<sup>3</sup> A fundamental ingredient in the recipe for commercial success, TQM is necessary to ensure sustainable profitability and an enduring place in the market.

### More Than a Method

TQM is more than a quality method; it combines management methods and economic theory with organizational principles to institute a sound business improvement doctrine that results in commercial leadership. It is a way of emphasizing that quality, as defined by the customer, results from the integration of multiple cross functional workflows throughout an organization. The essential ideology of Feigenbaum's systematic approach is summed up in the following tenets:

- Quality is an organizationwide process.
- Quality is what the customer says it is.
- Quality and cost are a sum, not a difference.
- Quality requires both individual and teamwork zealotry.
- Quality is a way of managing.
- Quality and innovation are mutually dependent.
- Quality is an ethic.
- Quality requires continuous improvement.
- Quality is the most cost effective, least capital intensive route to productivity.
- Quality is implemented as a total system connected to both customers and suppliers.

The very familiarity of these tenets is a tribute to the success and acceptance of Feigenbaum's total quality work.

His contributions represent some of the genetic code of today's management practices. He wove the following principles of managerial economics

and process thinking into his approach to business leadership:

- The customer-to-customer analysis of business processes.
- Integrated measurement of business processes.
- Analysis and improvement of major business processes to stimulate commercial success.
- Cost based analysis methods to identify process performance improvement opportunities.

### Historical Context

Whereas other early practitioners of quality focused on inspection and statistical sampling theory or the use of statistics for process control, Feigenbaum was the first to define a systems engineering approach to quality.

Prior to his work, there were two dominant quality schools of thought:

1. During the first half of the last century, Walter Shewhart, Ellis Ott, Harold Dodge, Harry Romig, Eugene Grant and W. Edwards Deming focused on statistical methods for delivering high quality products through acceptance testing and statistical process control.
2. In the early 1950s, Deming, Joseph M. Juran and Peter F. Drucker also emphasized management based systems to improve manufacturing performance and business practices.

At about this time, Feigenbaum advanced technology management by defining a new approach to quality based on economics, industrial engineering—including an emerging engineering discipline called systems theory—and management science, combined with the existing statistical and management methods.<sup>4</sup>

Over the next 30 years, most of the quality related books, with two notable exceptions, were reflections on the work of these men. The two exceptions are *Quality Is Free* by Philip B. Crosby<sup>5</sup> and *Out of the Crisis* by Deming.<sup>6</sup>

Crosby encouraged the pursuit of zero defects and application of Feigenbaum's cost of poor quality indicator as the business measurement standard to assess nonconformance to customer requirements. Deming contributed to the quality body of knowledge in the field of sampling theory and through his advocacy of quality principles to help management achieve profound knowledge of business processes using statistical tools.

# Career Highlights

As the hands-on manager and champion of quality at General Electric (GE) from 1937 to 1968, the early phases of Armand V. Feigenbaum's career set the tone for his most significant contributions.

Feigenbaum began his career with GE in 1937 as an apprentice toolmaker and management intern with the turbine, engine and transformer group. He entered Union College in Schenectady, NY, in 1938 to study engineering while continuing his work at GE. His coursework focused on mathematics, statistics, engineering and economics. When he graduated in 1942, he joined GE as a full-time design engineer.

During World War II, Feigenbaum supported the war effort as an aircraft engine designer. When the German air force destroyed the Rolls-Royce engine plant in Coventry, United Kingdom, the U.S. Air Force immediately assigned the design and development of all allied aircraft engines to GE. Because the quality of these engines was so essential to the war effort, Feigenbaum was asked to establish GE's first quality control engineering unit.

In 1943, he was transferred to GE's 45,000-employee Schenectady Works plant in New York to help design engines for the P-38 and P-47 fighters and related naval aircraft. Later that year, he was named manager of quality control for the entire site, which served as the hub of GE's military effort and supported the building of products as diverse as submarines, B-29 bombers and the Vulcan cannon. This was a significant responsibility for the 23-year-old Feigenbaum and evidence of management's high regard for his work.

Following the war, he progressed through a series of increasingly responsible line management jobs while working on his graduate studies at the Massachusetts Institute of Technology. Once he earned his doctorate, he was transferred to Cincinnati as assistant general

manager for GE's aircraft engine business, which built the jet engines used in the F-90 Shooting Star fighter during the Korean War.

As part of his collateral responsibilities as a GE manager, Feigenbaum was the champion for the management development program and leader of the team that established the GE Crotonville Learning Center in New York. He was subsequently promoted to GE's corporate headquarters in New York City where he flourished as the executive champion for quality.

As GE's global quality focus expanded, Feigenbaum made many international contacts with leading businesses in Europe and Japan. He worked with the local organizations in each country where GE had a plant to strengthen their knowledge and understanding of total quality by helping them install better quality control practices based on GE's practical experience.

GE's international influence was significant because it came from the strength of demonstrated performance, not pure theory. Companies could see the idea of total quality in action at their local GE facilities. The extended assistance provided to this global network of GE business partners allowed them to provide assistance to their nation's respective quality societies.

During this time, Feigenbaum served two terms as ASQ president (1961 to 1963) and co-founded the International Academy for Quality with Kaoru Ishikawa of Japan and Walter Masing of Germany.

In 1968, after 25 years of applying quality techniques at GE, Feigenbaum established General Systems Co. (GSC) to conduct further research on technology management and expand the outreach of his ideas to other organizations. GSC was one of the first engineering organizations dedicated to business improvement through use of quality management and statistics methods.



Many of these initial contributions were not recognized by senior managers as critical success factors for sustained business growth until a televised documentary about Deming called “If Japan Can, Why Can’t We?” aired in 1980. This coincided with the release of the third edition of Feigenbaum’s *Total Quality Control*, which provided the substantial engineering foundation for the next two decades of emphasis on total quality by American business.<sup>7</sup>

## Along with Deming and Juran, he established the intellectual framework for quality as a discipline worthy of top management’s attention.

At this crucial time, Feigenbaum served a pivotal role in the history of the quality movement. Along with Deming and Juran, he established the intellectual framework for quality as a discipline worthy of top management’s attention. While the quality movement had previously focused on production processes and product quality using basic statistical tools and analysis methods, **the extension of quality into all areas of business, including the service and public sectors, is Feigenbaum’s lasting contribution.**

The uniqueness of his contribution lies in the disciplined engineering approach he brought to the development of a systematic system of quality thought. Deming, a statistician, emphasized statistical thinking as the foundation for profound knowledge, and Juran, trained as a lawyer, favored a model that pursued financial and management frameworks.

Feigenbaum, however, developed the pragmatic engineering approach that established total quality—the breakthrough conceptual framework that has dominated the business world’s approach to delivering quality results for the last 50 years. Most

impressive, Feigenbaum developed his ideas before he turned 30 years old and was able to sustain the direction of these pursuits and extend them to ensure a mature practice that he shepherded into global acceptance.

### The Significance of His Ideas

Throughout his career (see the sidebar “Career Highlights,” p. 53), Feigenbaum combined academic theory with practical performance to hone his ideas into an approach that could be implemented as a general system of principles and behaviors at other organizations.

While his doctoral research described the economic relationship between quality methods employed during the manufacturing process and the potential economic benefit derived by business, Feigenbaum practiced his methods in the global framework of General Electric’s (GE’s) operations and strategic alliances with organizations such as Toshiba, Hitachi and Fiat.

While working in the aircraft propulsion sector of GE, he applied the lessons he learned at the Massachusetts Institute of Technology to ensure a pragmatic focus for observations about how productivity improvement could be achieved by driving quality in a different way from how it had been previously. The result of his integrated approach is the idea of total quality.

Feigenbaum also introduced two new concepts to the quality management discipline that served as a defining moment for business: systems engineering and economic accountability. Prior to his work, engineers had not focused on a systematic approach to business improvement, but had worked on symptoms that were presented through specific problems.

**By encouraging a systems approach, Feigenbaum focused organizations on building an understanding of the effects of the flow of their business operations and how one operation had subsequent impact on downstream components.** This systemic linkage among processes became the breakthrough concept for both just-in-time management in Japan and TQM.

The systems approach to quality has been a consistent theme across all of Feigenbaum’s intellectual contributions:

- He incorporated financial thinking into quali-

ty by conceptualizing the cost of poor quality.

- He integrated multinational thinking into quality by encouraging the development of quality organizations in Europe and Asia to help stimulate their economic recovery.
- He steered the structure of the Malcolm Baldrige National Quality Award as a member of its inaugural board of overseers, the group that helped create an operational definition of total quality in terms that could be broadly applied throughout society.

Feigenbaum's second influential concept, economic accountability, was introduced through his emphasis on the cost impact of poor performance. He studied the economic effects caused by poor performance and characterized the relationship between widespread quality improvement performance in a nation's leading businesses to quality's long-term economic effect, with a lag of approximately 20 years from the initial conceptual introduction.

While it may be too early to postulate a general theory of economics regarding the introduction of quality methods into an economic system, the evidence points toward the potential for this relationship as leading companies influence the supply chain of the national economic hierarchy and thus will be the propagators of new ideas in technology management.

## A Quality Role Model

Feigenbaum has been a role model for managerial innovation and its implementation. He could be perceived as a quality guru, except that label creates too distant an image of his activities over the past 50 years.

Feigenbaum has been much more than an academic; he has served as an executive player and coach. He coached business leaders in the fine points of engineering their businesses as coherent systems. He also acted to deploy his message through a pragmatic technology transfer of lessons learned and best practices to the implementation level to drive improvement into work processes at the frontline of operations.

Feigenbaum is not a pontificator on the philosophical principles of quality. Instead, he aims to understand the underlying relationships among operating principles and systematizes this knowl-

edge in a pragmatic way so it may be implemented and applied globally by others who have followed the discipline of total quality.

When history judges the breakthrough ideas and thought leaders of the 20th century, it will note Feigenbaum's enduring contributions. Blending perspectives of the pragmatic with the academic, the philosophical with the practical, the statistical with the humanistic and the managerial with the operational, Feigenbaum has earned a unique place in the history of engineering through his definition, advancement and execution of the principles of TQM.

## REFERENCES

1. From letters recommending Feigenbaum for the National Technology Medal, 2001-2003.
2. Ibid.
3. Ibid.
4. Ludwig von Bertalanffy, *General Systems Theory*, George Braziller, 1957.
5. Philip B. Crosby, *Quality Is Free*, McGraw-Hill, 1979.
6. W. Edwards Deming, *Out of the Crisis*, MIT Press, 1982.
7. Armand V. Feigenbaum, *Total Quality Control*, third edition, McGraw-Hill, 1983.

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