# **The History of Quality - Overview**

The quality movement can trace its roots back to medieval Europe, where craftsmen began organizing into unions called <u>guilds</u> in the late 13th century.

Until the early 19th century, manufacturing in the industrialized world tended to follow this craftsmanship model. The factory system, with its emphasis on product inspection, started in Great Britain in the mid-1750s and grew into the <u>Industrial Revolution</u> in the early 1800s.

In the early 20th century, manufacturers began to include quality processes in quality practices.

After the United States entered <u>World War II</u>, quality became a critical component of the war effort: Bullets manufactured in one state, for example, had to work consistently in rifles made in another. The armed forces initially inspected virtually every unit of product; then to simplify and speed up this process without compromising safety, the military began to use sampling techniques for inspection, aided by the publication of military-specification standards and training courses in <u>Walter Shewhart's</u> statistical process control techniques.

The birth of <u>total quality</u> in the United States came as a direct response to the quality revolution in Japan following World War II. The Japanese welcomed the input of Americans <u>Joseph M. Juran</u> and <u>W. Edwards Deming</u> and rather than concentrating on inspection, focused on improving all organizational processes through the people who used them.

By the 1970s, U.S. industrial sectors such as automobiles and electronics had been broadsided by Japan's high-quality competition. The U.S. response, emphasizing not only statistics but approaches that embraced the entire organization, became known as total quality management (TQM).

By the last decade of the 20th century, TQM was considered a fad by many business leaders. But while the use of the term TQM has faded somewhat, particularly in the United States, its practices continue.

In the few years since the turn of the century, the quality movement seems to have matured <u>beyond Total Quality</u>. New quality systems have evolved from the foundations of Deming, Juran and the early Japanese practitioners of quality, and quality has moved beyond manufacturing into service, healthcare, education and government sectors.

## Walter A. Shewhart



#### Father of statistical quality control

"Shewhart simulated theoretical models by marking numbers on three different sets of metal-rimmed tags. Then he used an ordinary kitchen bowl – the Shewhart bowl – to hold each set of chips as different sized samples were drawn from his three different populations. There was a bowl, and it played a vital role in the development of ideas and formulation of methods culminating in the Shewhart control charts."

- Ellis R. Ott, Tribute to Walter A. Shewhart, 1967

he industrial age was easing into its second century when a young engineer named Walter A. Shewhart came along and altered the course of industrial history. Shewhart, ASQ's first Honorary member, successfully brought together the disciplines of statistics, engineering, and economics and became known as the father of modern quality control. The lasting and tangible evidence of that union for which he is most widely known is the control chart, a simple but highly effective tool that represented an initial step toward what Shewhart called "the formulation of a scientific basis for securing economic control."

Shewhart was concerned that statistical theory serve the needs of industry. He exhibited the restlessness of one looking for a better way. A man of science who patiently developed and tested his ideas and the ideas of others, he was an astute observer of developments in the world of science and technology. While the literature of the day discussed the stochastic nature of both biological and technical systems, and spoke of the possibility of applying statistical methodology to these systems, Shewhart actually showed how it was to be done; in that respect, the field of quality control can claim a genuine pioneer in Shewhart. His monumental work, *Economic Control of Quality of Manufactured Product,* published in 1931, is regarded as a complete and thorough exposition of the basic principles of quality control.

A strong background in the sciences and engineering prepared Shewhart for a life of accomplishments. He graduated from the University of Illinois with bachelor's and master's degrees, and he received a doctorate in physics from the University of California at Berkeley in 1917. He taught at the universities of Illinois and California, and he briefly headed the physics department at the Wisconsin Normal School in LaCrosse.

Most of Shewhart's professional career was spent as an engineer at Western Electric from 1918 to 1924, and at Bell Telephone Laboratories, where he served in several capacities as a member of the technical staff from 1925 until his retirement in 1956. He also lectured on quality control and

applied statistics at the University of London, Stevens Institute of Technology, the graduate school of the U.S. Department of Agriculture, and in India. He was a member of the visiting committee at Harvard's Department of Social Relations, an honorary professor at Rutgers, and a member of the advisory committee of the Princeton mathematics department.

Called upon frequently as a consultant, Shewhart served the War Department, the United Nations, and the government of India, and he was active with the National Research Council and the International Statistical Institute. He was an honorary member of England's Royal Statistical Society and the Calcutta Statistical Association. He was a fellow and officer of the Institute of Mathematical Statistics, the American Association for the Advancement of Science, and the American Statistical Association, and a fellow of the Econometric Society, the International Statistical Institute, and the New York Academy of Science. He served for more than 20 years as the first editor of the *Mathematical Statistics Series* published by John Wiley and Sons.

Shewhart wrote *Statistical Method from the Viewpoint of Quality Control* in 1939 and gained recognition in the statistical community. In addition, he published numerous articles in professional journals, and many of his writings were held internally at Bell Laboratories. One of these was the historic memorandum of May 16, 1924, in which he proposed the control chart to his superiors.

An element in Shewhart's success was his searching out other bright and knowledgeable individuals for their ideas, methodically cultivating these sources and drawing from them information and advice in a way that endeared him to all. In a series of tributes to Shewhart published in *Industrial Quality Control* in August 1967, the most striking comment from the contributors—many of whom were themselves important figures in the development of the quality control field—was their respect for Shewhart's gentlemanly approach and sincere interest in the work and concerns of others. His character is summed up in comments made by the chairman of the committee that awarded the first Shewhart Medal:

The act of awarding the medal focuses the spotlight of public attention on the recipient, revealing in clear light the qualities that have won for him the esteem of his peers. What are the qualities that lead us to so honor a man as to give him a medal? First of all, he must have intellectual ability, enabling him to clear away a little of the dark cloud of ignorance that always surrounds us. Second, he must have the generosity of spirit that leads him to so express and restate his pioneering ideas that other members of his profession may benefit from them. And finally, he must have that warmth of human feeling that marks the true educator, endearing him to his students or disciples, even those who learn from him only remotely. All of these qualities are eminently personified in Dr. Walter Shewhart. (*Industrial Quality Control*, May 1949, p.26) Shewhart's influence on ASQ runs deep. Shortly before his death, he remarked to members that they "extended the field beyond my early visions and saw areas of service that pleased and amazed me. I hope that you continue."

Shewhart's legacy lives in mementos of him—a simple bowl and some numbered chips, a bronze medal, some books and writings—it lives in the succession of other prominent individuals he influenced, and it lives in the society of professionals who carry on the work he started.

## Joseph M. Juran

#### A search for universal principles



"It is most important that top management be quality-minded. In the absence of sincere manifestation of interest at the top, little will happen below."

The only thing that distinguishes these comments from those heard commonly today is that they were written in 1945 by Joseph M. Juran, ASQ's eighth Honorary member.

By 1945, as local quality control societies were forming the regional organizations that would merge into a national quality group, Juran was about to embark on his second career, which would earn him more than 30 awards from organizations around the world, including ASQ's Edwards Medal and Brumbaugh and Grant Awards. Juran joined the Bell System as an engineer in 1924; two years later, he was one of three people assigned to a new department formed to carry out what is known today as statistical quality control. Juran prepared what may have been the first text on statistical quality control—and perhaps the ancestor of today's widely used *Western Electric Statistical Quality Control Handbook*.

That early interest in writing and teaching foreshadowed the course Juran's career would take; within a few years, he became involved in quality management and the subject to which he would devote his life: management. The stage was set and the government, as if on cue, called on Juran to serve as an administrator in the Lend-Lease Administration—an event that was a key step for Juran.

The son of an immigrant, Juran was seeking security when he went to work for the Bell System in the years following World War I. He lacked the clear sense of direction that marked his later life; by his own admission, he was "in the grip of forces more powerful than I was." He expected to spend his entire career at the Bell System, but after four years on a leave of absence for government service, Juran decided not to return to the company. He had begun career in research, lecturing, philosophizing, consulting, and writing on management.

Juran's second career began from a base at New York University, where he served for a time as head of the Department of Industrial Engineering. His arrangement with NYU allowed him to spend a good deal of time on matters not connected with teaching. One was the writing and editing of the *Quality Control Handbook*. First published in 1951, the *Handbook* has grown from 15 chapters to 52, paralleling and aiding the growth of the quality field.

During the late 1940s, Juran began to develop what may have been the most influential course on the subject of quality since the eight-day seminars conducted during World War II. Juran's "Managing for Quality" has been taught to more than 100,000 people in over 40 countries.

For almost 30 years, Juran offered the course through the American Management Association, the second institutional base of his second career. Given his longstanding interests, Juran's association with AMA is not surprising. His writings in *Industrial Quality Control* during the 1950s and 1960s also reflect his interest in management. As a contibuting author and editor for 16 years of "Management's Corner," Juran frequently emphasized the role of management in quality. He saw early on the broadening role of quality and urged quality professionals to prepare for it.

Juran's reputation in quality management led the Union of Japanese Scientists and Engineers to invite him to Japan in 1954. In his book *What Is Total Quality Control? The Japanese Way,* Kaoru Ishikawa describes what happened:

[Juran] conducted seminars for top and middle-level managers, explaining to them the roles they had to play in promoting QC activities.

Japanese managers had shown little understanding or interest when those young quality control research group members explained QC to them, but Dr. Juran, with his worldwide reputation, was more persuasive.

Juran's visit marked a transition in Japan's quality control activities from dealing primarily with technology based in factories to an overall concern for the entire management. The Juran visit created an atmosphere in which QC was to be regarded as a tool of management, thus creating an opening for the establishment of total quality control as we know it today.

Juran gives more credit to the Japanese than to Americans for what transpired over the next 30 years. What would have happened if no American experts had lectured in Japan in the 1950s? About the same that did, Juran believes: "It might have taken them two or three years longer to arrive at the same place," he said. Indeed, by the 1960s, Juran began to report to Americans on the new ideas on quality coming out of Japan—ideas like quality circles.

Juran's teaching led to the publication of another major book in 1970. *Quality Planning and Analysis,* co-authored with Frank Gryna, was written to fill the need for a textbook on the subject of quality. Like the *Handbook,* it has been a bestseller since it first appeared.

For three decades, NYU and AMA gave Juran a great deal of flexibility; the idea of creating his own company was unsettling. "I was afraid of it for years," he said. Nevertheless, in retrospect, the Juran Institute seems a logical extension of his style of working. Juran's objective has always been

to capture the universals that lay behind daily experiences. He has even analyzed the process by which he arrives at these general principles: experience, reflection on that experience with an eye to discovering broader truths, presentation of the ideas for comment and discussion, refinement, and finally publication in a paper or book.

The process of developing ideas has been a gradual one for Juran. Top management involvement, the Pareto principle, the need for widespread training in quality, the definition of quality as fitness for use, the project-by-project approach to quality improvement—these are the ideas for which Juran is best known, and all emerged gradually.

But at least once an important idea appeared in what Juran remembers as "one of those blinding flashes of illumination." The illumination came from the work of anthropologist Margaret Mead, who showed that cultural patterns were at the root of the resistance to change that doomed many of the efforts of technical experts sent overseas to modernize living conditions. Juran immediately applyied this insight to the practical needs of managers. He developed his ideas in a series of papers—one of them a Brumbaugh Award winner—and in presentations to a wide range of audiences. He then set down the fruits of his intellectual labor in *Managerial Breakthrough*.

In Juran's philosophic approach there is an implicit recognition of the need to communicate. Not surprisingly, Juran's writing is as clear and elegant as are his ideas. Moreover, Juran has always had a lively interest in language, reflected in his discussions of proposals to use words like "ophelimity" to take the place of the misunderstood word "quality." A sense of humor has always enlivened his prose, as when he observed that one reason for buying the *Quality Control Handbook* is to impress visitors.

But impressing readers is not Juran's objective, nor are humor or smoothness of style his major accomplishments. In fact, describing Juran's career briefly is a daunting task. While introducing Juran at the Annual Quality Congress in 1986, then ASQ president Dana M. Cound recalled a similar dilemma facing a sports announcer who introduced a man who had played almost every position in baseball with grace and skill. Rather than trying to enumerate the player's accomplishments, his introduction was both direct and comprehensive: "I give you Jim Gilliam, baseball player." Cound followed that lead and summarized a distinguished career very simply saying, "I give you Dr. Joseph M. Juran, teacher."

Learn more about <u>Dr. Juran</u>'s life work at the Juran Institute.

## **W. Edwards Deming**

#### A mission pursued on two continents



W. Edwards Deming, named an ASQ Honorary member in 1970 for his role as adviser, consultant, author, and teacher to some of the most influential businessmen, corporations, and scientific pioneers of quality control, is the most widely known proponent of statistical quality control. He has been described variously as a national folk hero in Japan, where he was influential in the spectacular rise of Japanese industry after World War II; as a curmudgeon; as the high prophet of quality control; as an imperious old man; and as founder of the third wave of the Industrial Revolution.

Deming was trained as a physicist, taking a doctorate at Yale University in 1928, following previous degrees from the University of Wyoming and the University of Colorado. His extensive list of published works (nearly 200 papers, articles, and books), include early publications on a variety of topics in the field of physics. Later publications reflect his growing interest in the application of statistics.

While working as a mathematical physicist at the U.S. Department of Agriculture in 1938, Deming was responsible for courses in math and statistics at the Graduate School of the USDA, and he invited Walter Shewhart to lecture there.

Later in I938, Deming moved to the Bureau of the Census, where he was an adviser in sampling. In what is probably the first application of statistical quality control principles to a non-manufacturing problem, Deming brought Shewhart's principles into use on clerical operations for the 1940 census.

In 1942, while at the Bureau of the Census, Deming was retained as a consultant to the Secretary of War and was asked by W. Allen Wallis, a statistician at Stanford University, for ideas on ways to aid the war effort. Deming suggested a short course in Shewhart methods to teach the basics of applied statistics to engineers and others. The idea was adopted quickly and enthusiastically, and the first course was held in the summer of 1942. Among the instructors were Deming and Ralph Wareham, and the attendees included Holbrook Working and Eugene L. Grant of Stanford. The courses were repeated many times, often with Deming as instructor. The influence of the courses on the individuals who formed the core of the statistical quality control movement in the United States and who founded ASQ is well known.

Because of his work at the USDA and his expertise in statistics, Deming was sent to Japan in 1946 by the Economic and Scientific Section of the War Department to study agricultural production and related problems in the war-damaged nation. He returned to Japan in 1948 to conduct more studies for the occupation forces.

During these trips, Deming made contact with Japanese statisticians and developed a lasting admiration and fondness for the Japanese people. Deming convinced Kenichi Koyanagi, one of the founding members of the Union of Japanese Scientists and Engineers (JUSE), of the potential of statistical methods in the rebuilding of Japanese industry. Koyanagi, in turn, suggested the idea to JUSE, which invited Deming to teach courses in statistical methods to Japanese industry. Under the auspices of the Supreme Commander of the Allied Powers, Deming arrived in Japan to teach in June 1950. He returned five times as teacher and consultant to Japanese industry.

Deming successfully influenced a new group of managers who had risen to the top in Japanese business after the war. They were hungry for new ideas to help them correct serious and persistent quality problems. Their interest was in contrast to behavior in the United States, where management was abandoning the precepts learned in the wartime quality control courses.

Deming gave his Japanese students not only statistical theory, but also confidence. "I told [Japanese industrialists] Japanese quality could be the best in the world, instead of the worst," he said. Still, many were skeptical. "I was the only man in Japan who believed that Japanese industry could do that." Deming made his prophetic statement that the Japanese could capture world market within five years if they followed his advice. "They beat my prediction. I had said it would need five years. It took four."

In recognition of Deming's efforts in Japan, JUSE created the Deming Prize in 1951. He was awarded the Second Order Medal of the Sacred Treasure by Emperor Hirohito in 1960.

During the period of his activities in Japan, Deming pursued a similar mission in the United States. However, it has taken the United States much longer to pay attention to his teachings. In 1946, he became a professor of statistics in the Graduate School of Business Administration at New York University, and he began the consulting practice that he maintained until his death in 1993.

The need for a working understanding of basic statistical principles is at the heart of Deming's teaching. "Statistical theory has changed practice in almost everything. Statistical techniques, in their ability to aid the discovery of causes, are creating a science of management and a science of administration," he said in accepting ASQ's Shewhart Medal for 1955. His message, directed primarily at management, is stated succinctly in his famous 14 points for management: Create constancy of purpose for improvement of product and service. Adopt the new philosophy. Cease dependence on mass inspection. End the practice of awarding business on price tag alone. Constantly and forever improve the system of production and service. Institute modern methods of training on he job. Institute modern methods of supervision. Drive out fear. Break down barriers

between staff areas. Eliminate numerical goals for the work force. Eliminate work standards and numerical quotas. Remove barriers that hinder the hourly worker. Institute a vigorous program of education and training. Create a situation in top management that will push every day on the above points.

These points and many others distilled from a lifetime of consulting, teaching, and listening, were collected in his influential 1982 book *Quality*, *Productivity and Competitive Position*.

In the years before his death, Deming was in demand as a consultant and lecturer. Among the quality control masters, only Deming gained anything approaching cult status. His notoriety in the popular media dated to a 1980 NBC television documentary called "If Japan Can, Why Can't We?" in which he was featured prominently. The attention sometimes focused on his bluntness and brusque lecturing style, ignoring the substance of his message and leaving some misperceptions about the man, according to those who knew him well.

"Deming tends to be thought of as confrontational; in fact, he is a very kind and thoughtful person. He has always taken the time to help anyone who showed a desire to learn. It is no coincidence that so many people have come to think so highly of him. If he appears impatient, particularly with management, it could be that he sees a large task ahead of him and not much time left," quality consultant William Latzko said. "He's a very ethical man. He practices what he preaches," Edward Baker of the Ford Motor Co., a frequent Deming client, said.

In rare moments when he was not pursuing his mission, Deming polished his skills as an organist and music composer. His version of the national anthem, which addresses people's inability to hit all the notes, serves as a metaphor for one of his points for management: don't blame the singers (workers) if the song is written poorly (the system is the problem); instead, rewrite the music (fix the system). In life and in art, Deming simply wanted to make it easier for people to sing.