A Chronology of Quality

Presented By:

Dr. Yasser Mostafa
Quality & Food Safety Manager
MARS - KSA
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A History of Managing for Quality
A History of Managing for Quality

Joseph Juran’s traced the history of quality management back to the time when the pyramids were built in Egypt.
Industrial Revolution

However, until the advent of the industrial revolution, when mass production also appeared, quality management involved little more than craftsmen checking their own work.
A History of Managing for Quality

- The need for quality in the production of parts increased when the U.S. system of manufacturing required parts to be produced exactly alike.

- Mass production’s origins can be traced to the French General Jean-Baptiste de Gribeauval, who attempted to standardize parts in the French arms industry in 1765.

- The U.S. War Department was heavily influenced by the French around this time, and started experimenting with interchangeable parts at federal armories.

- In addition to interchangeable parts, the U.S. government encouraged mechanization at federal arsenals. This system was known as the **American system of manufacturing**.
The rise of Statistical Methods in Quality
The rise of Statistical Methods in Quality

- After the arrival of mass production, product quality was dependent on inspectors.

- There were breakthroughs in quality control at the Western Electric Co.’s Hawthorne plant, a division of AT&T.

- The plant itself was made famous in industrial psychology because of the Hawthorne Experiments, which determined that employees work better when they feel that management has taken an interest in them.
Inspection Problems

Juran worked at the department around the time when it was attempting to scientifically determine optimal sampling plans.

There were many weaknesses in the Hawthorne plant’s reliance on inspection. Here are a few examples:

1. Waste was created from producing defective products.
2. Production workers did not have a say in controlling their own work.
3. Inspection gauges sorted good product from bad without providing feedback about the process.
4. Sampling tolerated only a specific percentage of defective parts.
5. Inspectors were not capable of detecting 100 percent of the defective
6. Another problem with inspection was that even if defective parts were prevented from reaching the customer, the customer would still pay for the defects because of the higher cost of producing the parts if many were defective.

7. The cost of inspection itself would also be a factor that could drive up the cost of finished products.

Overall, relying on inspection represented an acceptance of waste that generated higher costs for the consumer.

For example, when Juran started at the Hawthorne plant, 5,200 workers out of 40,000 were employed in the inspection department. Most of these workers inspected and tested the product. Other workers calibrated the various gauges and meters used by the inspection department. The products Hawthorne shipped were high quality; however, the costs were proportionately high because of all the people involved in inspecting and reworking the products.
Harold F. Dodge started as a development engineer at Western Electric Co. in 1917.

He explains that during the early 1920s, industry was attempting to work scientifically using Frederick Winslow Taylor’s theory of scientific management and tools such as Gant charts.

At this time industry was trying to strike a balance between costs and schedules, and quality entered the equation as a new factor that needed to be added in. The new management methods became known as “quality control.”

Many techniques, such as sampling plans and statistical process control, were soon being referred to as “statistical quality control.”
Quality Control rise with Western Electric

In 1924 Bell Labs, owned by Western Electric Co., used 100-percent testing and inspection to determine if products were in conformance with requirements, and many products were reworked so they would function correctly.

The risk of having material rejected influenced producers to improve their quality.

As a result, inspections were decreased as the amount of sampling increased, inspectors received better training, and measurement accuracy was improved.
Walter Shewhart was one of the engineers at Bell Labs, and he created the Control Chart on May 16, 1924.

The chart could determine if a process was stable and produced parts that were within specification limits.

The control chart used mathematical formulas to determine an upper and lower control limit. If a part was outside of these limits, then there was reason to think that there were parts out of specification, and all parts needed individual checking.

An unstable process was also a signal for the operator to check the machine that produced the parts.
Shewhart’s control charts took many years to be implemented at the Hawthorne plant.

Juran reports that he tried to encourage managers to use the charts but seldom succeeded.

He could not understand managers’ reluctance, but he later understood that managers’ priority was to ship products.

Also, workers got bonuses based on a piece-rate system, another incentive to ship as much product as possible.
In 1925 Bell Lab’s inspection engineering department and Hawthorne’s inspection branch formed the Joint Committee on Inspection Statistics and Economy.

The Hawthorne plant started a new department called the Inspection Statistical Department, and Juran was one of the engineers there.

Statistical sampling plans were made based on production lots, and each lot was permitted to have a specific percentage classified as defective.

A single random sample was used to determine if the lot should be accepted or rejected.
In 1926 Juran realized that there would be:

- No defective parts in the lots if the production process was perfect,
- No defective parts also in the lot if the process was very bad because defects would be found during random sampling, and the entire lot would be 100-percent inspected.

However, if the process was somewhere between the two extremes, there would be some defective parts in the lot. Juran called this “the average outgoing quality level - AOQ.”

The Hawthorne plant’s sampling plans were eventually issued in a U.S. government standard called MIL-STD105A.
MILITARY STANDARD

SAMPLING PROCEDURES AND TABLES
FOR INSPECTION BY ATTRIBUTES

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.
In 1931 Shewhart published *Economic Control of Quality of Manufactured Product*, which was edited by W. Edwards Deming.

Shewhart started lecturing on the use of statistics within the field of quality.

Shewhart’s 1938 lectures at the U.S. Department of Agriculture’s Graduate School became the basis for his 1939 book, *Statistical Method From the Viewpoint of Quality Control*. 
Quality and World War II

World War II
1939 - 1945
Before the start of World War II, Shewhart advised L.N. Simon of the Pentagon’s Ordnance Department to use statistical methods.

The Ordnance Department decided it must either
- Train all suppliers in statistical process control, or
- Must implement acceptance sampling.

It chose acceptance sampling because of the large amount of material that was needed in a short period of time.
During the early 1940s, Deming recommended that Stanford University’s statistics department teach statistical process control.

Juran explains that the War Production Board assigned university statistics professors the task of training government contractors in the use of Shewhart’s control chart.

*The main effect of these classes was the rise of quality engineers and quality managers within factories, as well as the start of quality departments within many manufacturing companies.*

There were other breakthroughs in quality during World War II, but most were related to inspection and sampling techniques.

At the time, the emphasis was on technical solutions to quality problems, and there was little worker involvement. The main objective was often to meet delivery *schedules*, and quality came second to that goal.
Statistical Process Control

- Some progress was made in using statistics during World War II.

- A U.S. government report on industrial research mentioned how useful statistics were in purchasing munitions. The report notes that the days when engineers considered mathematicians to be strange and incompetent had ended.

- The report also referred to Shewhart’s *Statistical Methods from the Viewpoint of Quality Control* and quoted Juran, who explained that inspection both removes defective parts and alerts the manufacturer to the existence of a problem.
A 1947 report from the National Academy of Sciences explained that before World War II, statistical methods were not well known in industry outside of Bell Telephone; however, many companies quickly started using statistics for accepting or rejecting deliveries based on statistical sampling.

The report was intended to be distributed to organizations that could teach statistics.

According to the report, the Office of Production Research and Development of the War Production Board started teaching statistical process control for production people and engineers in 1947.

About 2,000 people from more than 800 companies attended the training classes. Shewhart was the chairman of the subcommittee on statistical quality control.
In his *A History of Managing for Quality* Juran explains that many companies stopped using statistical process control after World War II because:

1- Companies did not think it was economical.
2- There was also a shortage of consumer goods at the end of the war, and
3- Meeting delivery schedules took priority over quality.

Some of the new quality engineers participated in quality planning, wrote quality reports, wrote procedure manuals, and performed quality audits. Some companies created quality control departments run by managers who had been in charge of the former inspection departments. Around this time quality departments began to be placed under management in organizational diagrams.
Post-war Developments in Quality
Post-war Developments in Quality

After the end of World War II, U.S. industry had become a seller’s market, and the priority for manufacturers was quantity over quality.

Many companies discontinued the use of statistical process control, and even AT&T abandoned Shewhart’s control chart during the 1950s.

Business schools at this time also taught that increased quality was the equivalent of increased costs, and this theory together with a seller’s market lowered the quality standard in U.S. industry.
In 1946 Preston Wescot, who had been one of the War Production Board statistical quality control instructors, got together with George Deforest Edwards, Bell Labs’ director of quality assurance, and eight other men to form the American Society for Quality Control (ASQC). The new society was a merging of 17 different quality societies and originally had 253 founding members.

By the end of 1946, there were more than 1,000 members. The society held its first annual convention in June 1947, at which time Walter A. Shewhart, a founding member, was voted an honorary member, and the society’s Shewhart Medal was created. ASQC dropped the word “Control” from its name in 1997.
Japan Quality Rise
As U.S. quality was declining during the post-war selling frenzy, Japan was struggling to rebuild after the devastation of World War II. Although the Japanese were capable of producing high-quality war machines, the country had a reputation in the West for low-quality goods. Japan had very few natural resources and realized it needed to produce quality goods to build an export market.
In early 1946 Gen. Douglas MacArthur asked a radio engineer named Homer Sarasohn to go to Japan to help rebuild the country’s war-torn radio industry.

MacArthur wanted to broadcast to Japanese households, but factories had been bombed during the war and couldn’t produce radio receivers, and most of their upper managers had been killed or jailed.

MacArthur ordered that training be conducted to remedy this.

Charles Protzman arrived to help Sarasohn in 1948, and together they prepared the textbook, *The Principles of Industrial Management*, which they used to train managers in manufacturing and mass production. The textbook contained a section on quality control, which some Americans objected to because they feared it would make Japan too much of a competitive threat.
In 1950 Sarasohn invited W. Edwards Deming to teach statistical process control in Japan.


The Japanese eventually invited Juran to Japan to teach them about quality.

Deming was invited to lecture on statistical quality control by the Union of Japanese Scientists and Engineers (JUSE) three years after the group started working with quality control.
Many people credit Juran and Deming with improving the quality of Japanese products; however, Juran believes that Japan’s quality revolution was the most important thing to happen after World War II, and that it would have happened even if he and Deming had not gone to Japan. During his lectures Deming went beyond just teaching statistics and explained the plan-do-check-act (PDCA) production cycle to Japanese managers.
PDCA is used to ensure that the customer’s wants and needs are considered throughout the production of a product.

The four steps begin during the product design phase and are repeated throughout the product’s manufacturing. Gabor notes that at that time, General Motors used to design a vehicle and then rely on sales pitches and advertising to sell it. In comparison, a company using plan-do-check-act will study what customers really want and design a product that meets these needs. Using PDCA helped Japan design and build products based on customers’ requirements.
In *The New Economics*, Deming places the responsibility for quality on management’s shoulders rather than workers’, stressing that workers “can only try to do their jobs.”

“Job security and jobs are dependent on management’s foresight to design product and services that will entice customers and build a market,” he says.
Kaoru Ishikawa and quality circles

Kaoru Ishikawa explains that if quality control places an emphasis only on inspection, then only one department within a company is involved. Then: “All they need to do is stand at the exit and guard it in such a way as to prevent defective products from being shipped,” he says. “If a quality control program emphasizes the manufacturing process, however, involvement is extended to assembly lines, to subcontractors, and to the divisions of purchasing, production engineering, and marketing.”

Kaoru Ishikawa worked as a production engineer at Nissan Liquid Fuel Co. He joined the Quality Control Research Group of the Union of Japanese Scientists and Engineers in 1949.

Ishikawa believed that PDCA was the most important part of quality improvement, and that processes needed to be controlled to control product quality.
Ishikawa in *What Is Total Quality Control?* explains that all divisions within a company should be involved in quality control, and that this is how one meets the needs of the customer.

He also says that workers and foremen must be good at what they do in order for quality control to function. However, it was not easy to educate workers and foremen in Japan during the late 1950s. To address this problem, the Japan Broadcasting Corp. aired programs aimed at introducing quality control to workers and their supervisors. Supervisors asked for their own quality-related journal in 1962; Ishikawa worried that many supervisors would not read the journal, so he advocated quality circles, where those who read the journals could talk to those who didn’t.

Ishikawa states that quality circles are intended to contribute to the improvement and development of the company. Quality circles are to be organized on a voluntary basis from the bottom up and not top down, and they are a form of democratic management.
Many U.S. managers went to Japan to witness quality circles in action, but failed to notice that they were just one part of a bigger picture.

Japanese companies that used quality circles also had engineers and managers working on quality problems and problem prevention, but the visiting U.S. managers failed to notice this.

In his autobiography, *Architect of Quality*, Juran observed that quality circles did produce spectacular results, but they were part of an overall system and not the single cause of quality in Japanese products.

The American use of quality circles increased dramatically during the early 1980s and then quickly declined, although some circles were still going into the 1990s.

The quality circles that did survive did so in a changed form.
While Japan was organizing quality circles, the United States started the zero defects movement based on the writings of Philip B. Crosby.

In his book, *Quality Is Free*, Crosby explains that mistakes are caused by lack of knowledge and lack of attention. He believed that lack of knowledge can be corrected through proven methods, but lack of attention requires a person to reappraise his morals because he has an attitude problem.

Crosby proposed that simply paying attention is a major step on the way to achieving a zero defect rate. He also said that management must inform workers of the need for a zero defects mindset and claimed that 85 percent of all problems can be solved by the immediate supervisor. Of the remaining 15 percent, 13 percent can be solved within the next two levels of supervisors or departments.
In search of zero defects

In 1965, Kaoru Ishikawa recalls observing the zero defect movement first-hand. He predicted that it would fail because it was “a movement without tools” and became “a movement of mere will” that “emphasized that if everybody did his best, there would be no defects.” Ishikawa added that the United States was heavily influenced by Taylorism, where “workers are regarded as machines” and “their humanity is ignored.”
During the early 1960s, Shigeo Shingo proposed a method of dropping the defect rate down close to zero using his successive check method. This method calls for workers to inspect each item they receive when they receive it. This would allow for the work of the person in the previous operation to be checked, and mistakes would be caught much more quickly than by using inspections or statistical process control at the end of the manufacturing process. Shingo gives the example of one television manufacturing company that had a 15-percent defect rate. The company was able to reduce that to 6.5 percent by using quality circles and statistical process control. When the company began to use Shingo’s successive check method, the defect rate dropped to 0.016 percent.
Shingo explains that people forget things, and urging production workers to simply pay more attention is “as good as asking workers to become god.”

He recommends *poka-yoke*, which means mistake-proofing—the use of a method or device that prevents a mistake from being made or makes the mistake obvious at a glance—therefore attaining zero defects.
Management Responsibility

In one of his articles, Juran claimed that most quality-related mistakes could be controlled by management, and that the remaining errors are caused by situations such as lack of worker skill or conflicting standards.

He also reviewed the state of quality in different parts of the world and found that although U.S companies often had a quality department, quality-related training was lacking for supervisors, and it was often difficult for quality professionals to work with other departments within an organization.
Juran thought that Taylorism made sense at a time when workers and line supervisors didn’t have the skills or education for making decisions, but now planning and performing should be recombinated in the United States. He found that Western European companies often had line supervisors with more authority than U.S. supervisors as well as workers with more skills than their U.S. counterparts, but he believed that Eastern European quality was hampered by central planning that protected companies from the demands of the market and a lack of competition. This protection made it difficult for them to solve quality-related problems.

In 1969, Juran stated that Japan’s quality revolution showed considerable promise for taking Japan to world leadership in the quality arena.
Beginning of the Quality Crisis
Beginning of the Quality Crisis in US

- During the 1970s and early 1980s, U.S. automakers could not compete with the quality of their Japanese counterparts.
- Automotive components are designed with a tolerance range, and even when U.S. manufacturers were producing parts to specification, they couldn’t compete with Japanese parts.
- For example, Ford Motor Co. was producing transmissions but was also ordering the exact same transmission from Japan.
- Transmissions made in the United States were failing far more often than the Japanese transmissions, so Ford engineers disassembled the two types of units to determine what the differences were.
- The Ford-built transmissions were all within the specification limits, but the measurements were all at different points within the tolerance range.
- The Japanese transmissions were built exactly the same, which eliminated variability and resulted in a better transmission.
Beginning of the Quality Crisis

In 1980, Ford finally realized something was afoot in Japan, so members of Ford visited a Japanese assembly plant to see what was going on. The Ford people observed that Mazda could assemble a car comparable to Ford’s with only 60 percent of the effort and far fewer quality problems. Chrysler spent part of the 1980s being supported by the U.S. government but failed to implement lean methods. Ford and General Motors were both in severe financial trouble too, but adopted lean methods to help save themselves.
Lean Manufacturing

During the 1970s and early 1980s, the auto industry wasn’t the only manufacturing arena in which the United States had trouble competing with Japan. The quality of U.S. consumer goods was terrible compared to Japanese goods, so many Americans were buying Japanese products, which resulted in U.S. manufacturing companies losing market share and workers losing jobs.

U.S. television manufacturers accused Japan of using low wages and government subsidies to help Japanese television manufacturers. Zenith Radio Corp. even filed a dumping petition against Japan. However, Japanese manufacturers were using lean manufacturing methods to produce televisions, and this helped them to produce higher quality products at lower prices.
Although lean manufacturing isn’t the same as quality assurance, it does contribute to quality. Defective parts are identified more quickly because the parts are used soon after they are produced. During the mid-1970s, the failure rate for U.S. televisions was five times higher than for those made in Japan. Most consumers don’t purchase televisions frequently so may not have realized the quality difference between Japanese and U.S. televisions, but as Juran noted, bulk buyers, like hotels, did. During this time, nearly one-third of U.S. workers in the television manufacturing industry lost their jobs.
If Japan Can, Why Can’t We?”
Crosby published *Quality Is Free* in 1979, which helped increase awareness of the need for quality. This was followed in 1980 by a wake-up call for U.S. industry when the documentary “If Japan Can, Why Can’t We?” from the series *NBC White Paper* aired on NBC. This documentary was created by Lloyd Dobyns and Clare Crawford-Mason and introduced U.S. executives to W. Edwards Deming and the Japanese quality movement.

Juran’s 1969 prediction that Japan would lead the world in quality had come true.

U.S. manufacturers were still producing as though they were in a seller’s market, but the documentary clearly illustrated that things had changed, and U.S. manufacturers would have to change how they did business.
“If Japan Can, Why Can’t We?” was the tipping point that launched U.S. industries interest in quality;

Juran thought the documentary set the quality movement back by five years and disagreed with the credit it gave to Deming and himself for bringing quality to Japan.

There are men known as gurus in the field of quality. Although they aren’t the only ones who helped spread the word about quality, they are the most famous.

In the United States, Deming, Juran, and Crosby are honored with guru status as are Armand Feigenbaum and Walter Shewhart. Among the quality gurus in Japan are Ishikawa, Shingo, Genichi Taguchi, and Taiichi Ohno.
Quality Gurus

Deming
W. Edwards Deming

Crosby
Philip Crosby

Juran
Joseph Juran

Shewhart
Walter Shewhart

Feigenbaum
Armand V. Feigenbaum

Ishikawa
Kaoru Ishikawa

Taguchi
Genichi Taguchi

Shingo
Shigeo Shingo
The increased interest in quality during the 1980s had a big effect on the American Society for Quality Control (ASQC).

Most managers seemed to view the society as an organization for low-level technical people.

By the end of the 1990s, however, service-sector membership had grown significantly, and many of the people in the ASQC were in high-level management positions.

In 1997 the ASQC changed its name to the American Society for Quality (ASQ) and focused on training for quality professionals, spreading the news about new ideas for quality improvement.
Quality and Six Sigma

The Six Sigma methodology is used to identify and control variables that affect the output of a process.

Frank M. Gyrna explains that Six Sigma “is a collection of managerial and statistical concepts and techniques that focus on reducing variation in processes and preventing deficiencies in product.” A process that is capable of operating at a Six Sigma level produces, on average, only 3.4 defects per million units.

In an interview with T. M. Kubiak, Armand Feigenbaum explained that GE built a quality system around statistical quality control that eventually came to be referred to as total quality management. Feigenbaum told Kubiak that when Bill Smith at Motorola was asked to find a way to use statistical quality control in nonmanufacturing areas like banking, he created Six Sigma under the leadership of Motorola CEO Robert Galvin.
Mike Carnell, a former Motorola employee, explains that Motorola developed Six Sigma during the 1980s as a survival strategy because it was having difficulties competing with Japan.

There is some criticism that Six Sigma only works for manufacturing, but Motorola also implemented it in human resources, purchasing, and accounting.

At Motorola, Six Sigma was just one part of a larger transformation that included cooperation between departments, employee participation, and financial improvement, as well as cycle time reduction.

Necip Doganaksoy and Gerald Hahn report that Six Sigma led to Motorola saving almost a billion dollars during a three-year period and was instrumental in the company achieving the Malcolm Baldridge National Quality Award. GE also saved more than a billion dollars in one year using Six Sigma.
Quality Awards and Certifications in US

During the 1980s, U.S. industry and the federal government voiced concern about low quality in American-made products and the country’s lack of competitiveness in the world market; multiple groups were formed to study the problem.

One of these recommended creating a National Quality Award similar to Japan’s Deming Prize.

A conference was held featuring President Ronald Reagan, Vice President George H. W. Bush, Secretary of the Treasury Donald Regan, and Secretary of Commerce Malcolm Baldrige as speakers.
Quality Awards and Certifications in US

During the conference, a report was released calling for a National Quality Prize, which was to be a medal awarded annually by the president. In September 1985, a committee to establish a national quality award was formed by corporate business leaders from the American Society for Quality Control, NASA, McDonnell Douglas Corp., Ford, and other organizations. In 1986, legislation was written for the award, and the bill passed Congress in 1987. Before the bill passed into law, Secretary Baldrige died from a rodeo accident, and the award was named in his honor. The Baldrige Award is administered by the Baldrige Performance Excellence Program, which is managed by the National Institute of Standards and Technology (NIST). The award recognizes U.S. organizations for achievements in quality and performance excellence.
By the late 1990s there was a quality award program in nearly every U.S. state—all based on the Baldrige Criteria for Performance Excellence.

In 1988, Utah State University created The Shingo Prize for Operational Excellence to honor Shigeo Shingo, the industrial engineer and thought leader whose management and improvement concepts and techniques are a fundamental part of the Toyota Production System.

The Shingo Prize recognizes business excellence around the world. European countries started creating quality awards in 1991.

By 2001 there were 19 different European quality awards, so to consolidate, the European Foundation for Quality Management created the European Foundation for Quality Management Award, now known as the EFQM Excellence Award, which has some similarities to the Baldrige Award.
Quality Standards

The first industrial standards organizations were formed in Great Britain in 1901, and by 1930 many countries started to use national standards organizations.


The ISO 9000 series of standards has been adopted around the world. In the article, “The Evolution of Six Sigma,” Jim Folaron warns that “the creation of ISO 9000 helped define many of the elements of sound quality practice, but it did not assure the product’s goodness or fitness for use; it only addressed consistency in the process. For example, a company that sells cement life jackets could be ISO 9000 certified.”

The automotive sub suppliers requested a single standard because they had been subjected to different standards for each company they supplied parts to.

The “Big Three” U.S. automakers based QS-9000 on ISO 9000 but didn’t copy it directly because it lacked elements that they needed in a standard, such as manufacturing capabilities and quality planning.

Similarly, the aerospace industry created AS9000 and telecommunications created TL9000.
In Italy, Fiat Auto and IVECO worked together with 85 suppliers to create AVSQ as an Italian automobile industry quality standard, and Renault, Peugeot and Citroen worked together with about 300 suppliers to create the French automobile industry quality standard EAQF. BMW, Opel, Audi, Daimler Benz, Volkswagen, and Ford Werke, together with 500 suppliers, created VDA 6 as a German automobile industry quality standard.

ISO attempted to convince all the automobile manufacturers to use the ISO 9001 quality standard due to the number of standards that had been created, but automakers found the ISO standard to be insufficient for their industry. Attempts were made to modify ISO 9001 for the automobile industry, but since the changes that were needed were not relevant to companies outside the auto industry, a new standard, ISO TS16949, was created and released in 1998.
Conclusion
Conclusion

- Quality assurance, quality control, and quality management must be integrated and used together to ensure overall quality.

- Statistical process control can signal when a process is no longer producing parts in specification, but it doesn’t matter if the parts are in specification if the wrong parts are being produced.

- Quality management provides a system to ensure that such mistakes don’t happen, but using quality management without quality assurance or quality control is also a mistake because defective parts can be produced even if the processes are functioning properly.

- Inspection can still play a role in modern quality; it may be needed to control the manual assembly of unique products, or in situations where there is a danger to life or limb in the event of a failure.

- However, companies shouldn’t rely on inspection exclusively because, as Harold F. Dodge famously said, “You cannot inspect quality into a product.”
The ideal quality system is one that uses quality management to define the processes that will ensure that a company is producing what the customer wants and needs.

Quality assurance is used to ensure that the production system is working properly, and quality control ensures that the product is produced in accordance with standards.

Quality assurance, quality control, and quality management are not standalone concepts; they are overlapping and complementary tools.

“The modern quality movement brings together ideas from, for example, systems analysis, operations research, problem solving, statistics, engineering, group dynamics, management science, human genetics, and organizational development,” says George E. P. Box

“The quality movement will, from time to time, undergo healthy changes and may even be called by different names. I am sure, however, that it is here to stay and can be of great benefit to all of us.”
Thank You!