Diploma in

Managing Quality in Higher Education

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THE ORIGINS OF THE QUALITY MOVEMENT

The importance of history cannot be understated. In *A History of Managing for Quality*, Juran wrote.

History enables us to retrace the past, to understand the significant events and the convergence of forces that stimulated those events. Study of history helps us to discover the trends and directions of past events and thereby to judge what may lie ahead. And of course, well-written history makes fascinating reading.

In recent years, the subject of managing for quality has gained prominence in the literature and in a growing number of manufacturing and service organisations. Quality has become a very powerful tool in international competition. Organisations as well as societies have come to realise that the pursuit of quality provides a safeguard against anything that threatens human health and safety, even the environment.

The subject of quality has had a long history. Its origin can be traced back to the beginning of civilisation. Since "quality is a timeless concept, so the origins of the human approach to managing for quality are hidden in the mists of the ancient past".[5] While the quest for quality has always been part of every human endeavor, only in recent decades has the subject of defining and managing for quality become a central focus of study. In view of this, the history of the origins of the quality movement merits careful study and attention.

QUEST FOR QUALITY IN ANCIENT SOCIETIES

Ever since civilisation began, human beings have always encountered problems pertaining to quality. Ancient food-gatherers had to learn which foods were edible and which ones were not. Hunters had to discover which tools would best serve their specific needs. During this era, quality was measured to some extent by how long these hunters and food-gatherers stayed alive.[6] The better the tools, the better their chances were of survival. Each primitive food-gatherer or hunter was able to define quality somewhat easily because he was supplier, producer, and customer of his own work.[7]

THE FAMILY UNIT

In the ancient past, the family served as the basic organisational unit of society. Primitive families had to provide largely for their own basic needs. They practiced division of labour to achieve production efficiency. Since the purpose of production was to provide mainly for family needs, the production processes, from design to actual use, were carried out by the same family members. Family members took all the initiative to check whether the products satisfied their intended uses in terms of satisfying their basic needs of food, shelter, and clothing. In essence, they determined what a "quality" product was. The major constraining factor in achieving quality during this time in history was the backward state of technology.

THE VILLAGE MARKETPLACE

As the number of families grew, people formed villages to provide for security and other social needs. The establishment of the village as a collective human organisational unit further enhanced division of labor and specialisation among members of the village community. Craftsmen of all sorts emerged, output increased, and inter-village trade flourished. In performing tasks over and over again, Craftsmen became better and better at what they did. They became very familiar with the production process, the raw materials used, the equipment employed, and the finished product.

The growth of trade among members of the village community facilitated another step in defining quality. The village residents who were the users of the product now decided what a "quality" product was, not just the Craftsmen or merchants. Producers and consumers met face to face with the goods between them. Due to the nature of the products sold, product quality could still be judged by the use of unaided human senses.

In the village market place, both the producer and the consumer were engaged in the inspection process. Producers strived to ensure that any defects were discovered during the production process or before the products reached the final customers. However, due to unavailability of sophisticated inspection equipment, some defective products were able to slip through. Buyers therefore needed to be vigilant by inspecting the products prior to purchase. While sellers were responsible for supplying the goods, buyers were responsible for supplying the quality assurance. This practice became widely known as *caveat emptor* or "let the buyer beware". In the exchange process, feedback from customers was prompt so that merchants were able to make correction or improvement to their products. As an additional impetus to maintaining high quality, village residents subjected both producers and consumers to close scrutiny and character evaluation. For the village craftsmen, the stakes were especially high. His status and occupation were closely tied to his reputation as an able and honest member of the village community.

QUEST FOR QUALITY IN THE PRE-INDUSTRIAL ERA

With the expansion of villages into towns and cities and the widening of the scope of regional trade, it became difficult for the producer and user to meet face-to-face in the marketplace. Between them emerged a host of suppliers, processors, and marketers. As a result, some new forms of quality assurance had to be invented to take the place of quality protections, which were traditionally inherent in the village marketplace. Examples of such forms were quality warranties and quality specifications.

Quality warranties were originally given by the producer to the buyer to provide the latter with quality assurance before the purchase and also relief or compensation in the event that the commodity did not live up to the buyer's expectation. Later during the medieval ages, the guilds took over this function. Over the years, quality warranties had become so widely used in all forms of trade and commerce that many governments legislated standards regulating their use in order to protect the buyers.

Quality specifications, like warranties, were of ancient origin.[8] The first type of specifications focused on defining products and processes but was later extended to the type of materials used in producing the commodity. Due to the differences in the measures used by the sellers and buyers, conflicts sometimes arose. To resolve these conflicts, standardised measures of length, volume, and time were invented. Since then, various instruments have evolved with ever-increasing precision.

THE ROLE OF THE CRAFTMEN

Craftsmen, tradesmen or artisans were those who acquired special skills in the performance of a sequence of tasks. Their ability to produce goods of high quality can be attributed to a number of factors.[9] The first factor was the training they received during the apprenticeship period. They were usually indentured at a young age for the purpose of learning a trade. As apprentices, they served their masters for a specified number of years in return for knowledge and skills learned. The second factor was the experience they acquired through many cycles of producing products. The more production cycles they went through, the more intimately familiar they became with the production process and the more skillful they became at performing a task or a group of tasks. The third factor was that while doing a sequence of tasks, the tradesman became repeatedly his own customer. The best way for him to discover quality problems was to use the product himself. It was easier for the tradesman to trace the cause or causes of the problems and correct them when he performed all the tasks required in a production sequence rather than when different people performed each task.

THE ROLE OF THE GUILDS

Guilds were prevalent during the Middle Ages until their influence was diminished by the onset of the Industrial Revolution. They were craft and trade organisations, which used their monopolistic powers, derived from charters provided by the prevailing authorities, to provide livelihood and security for members. The functions of guilds were extensive, from establishing rules governing apprenticeship and promotion to the grade of master to providing extensive social services to members and to playing an active role in the political affairs of the state.

Guilds played a very important role in managing and controlling for quality. As part of quality planning, the guilds established detailed specifications for input materials, production processes, finished products, and methods of inspection and test.[10] To assure that Craftsmen followed these specifications, the guilds established inspection and audit procedures, invented the mark or the seal to provide quality assurance to finished products, forbade the sale of poor-quality goods, established and enforced prices and terms of sale, and maintained equality of opportunity among members.

As an overriding goal, guilds sought to maintain solidarity and equality among its members by promoting only honest competition among them. No member was allowed to take advantage of other members. Unfortunately, quality improvement through product and process innovation was not considered to be honest competition by the guilds. This strong focus on guild solidarity stifled quality improvement and made the guilds lag behind other cities that did not have this restriction and were therefore free to create better products and processes.

THE ROLE OF THE GOVERNMENT

The functions of government have always included promoting the safety and health of its citizens, improving the state economy, and protecting the consumers against fraud and other forms of exploitation. Ancient laws were particularly harsh in dealing with quality failures. For example, any builder who built a poor-quality house could receive a death penalty if the said house later collapsed and killed the owner.

During the medieval times, quality was considered to be a serious issue. Rickert[11] in 1948 recorded an account of the infamous trial of John Welburgham that took place in 1392.[12]

On the eighth of May [1392], … [five citizens] came before the Mayor, sheriffs and aldermen… and showed to them two pieces of cooked fish … rotten and stinking and unwholesome … which they had bought of John Welburgham … at noon on the same day and which the said cook warranted to them to be good ….

And hereupon the said John Welburgham was immediately sent for, and being questioned, he said that he did sell … the said fish to be cooked … Wherefore it was awarded that the said John Welburgham should repay to said complainant six pence, … that he should also have the punishment of the pillory for one hour of the day, and that the said fish should then be burned beneath him.

In the above case, the whole town was involved and the sentencing was swift. John Welburgham was required to compensate his victims and endure public humiliation for the wrong that he committed. The severity of the punishment reflected the medieval obsession with quality. This societal attitude may be explained by an economic condition characterised by scarcity of resources and exorbitant cost of handcrafts goods. One bad purchase, therefore, could represent considerable loss.

With the growth of interstate commerce, government involvement in managing for quality became more pronounced as states competed with one another in many different ways including quality. To gain competitive edge over other states, governments encouraged quality improvement of domestic goods in order to increase exports. They imposed quality controls on exported goods by means of independent inspection and certification as shown by a mark or a seal. A mark was used to identify the producer, provide traceability, provide product information, and provide quality assurance. In the past, this was one way guilds and towns told their buyers, "This product has been independently inspected, and has good quality".[13]

Another area where governments increasingly delved themselves into was consumer protection. They recognised that some domestic trade practices existed where the *caveat emptor* principle did not apply. An example of such practice was related to units of measurement. The states standardised tools for different units of measurement and employed inspectors to ensure that these tools were properly used. From time to time governments intervened in the operation of the economy by imposing price controls and by maintaining a steady flow of raw materials and commodities especially during periods of economic shortage.

QUEST FOR QUALITY IN THE INDUSTRIAL AND POST-INDUSTRIAL ERA

The Industrial Revolution took root in Europe around the mid-1700s. The movement that finally gave birth to the factory system was made possible by the invention of power-driven machinery and the discovery of new sources of mechanical power. Reilly wrote:[14]

The machine would change every institution and activity known to humanity. What we preached and believed, our economics, cities and country sides, laws, politics, education, science, medicine, engineering, arts, wars, class structures, and environment, our concepts of progress, and our very dreams – virtually every aspect of human life – was to change drastically and with unprecedented speed.

The Industrial Revolution ushered in a new era in mass production and distribution, which led to the gradual demise of the craft system. The factory system soon created a setting for significant changes in the way quality would be defined and accepted.

THE ROLE OF THE FACTORY

The factory system enhanced production and distribution in a way that the craft system could not. With the aid of rapidly developing technology, factories were able to mass produce goods to such an extent that drastically reduced the average cost of production. During this period, the principles of division of labor and specialisation were widely employed. Whereas in the craft system the craftsman performed all the tasks needed to produce a commodity, in the factory system several or many factory workers performed each one of these tasks. Adam Smith first formally noted this difference between the two systems in his groundbreaking book *The Wealth of Nations*.

By reengineering their manufacturing processes, factories were able to achieve high productivity and lower costs. Mass production at low costs made manufactured goods affordable and available for consumption by the masses. The lower strata of society reaped the benefits of factory production, from blankets, pants, shirts, shoes, cooking utensils, and tools, to a myriad of other products so useful in daily life.[15] The demand increased so dramatically that a new system of distribution had to be put in place. The phenomenal growth in the supply of goods within reasonable reach of the masses greatly enhanced the standard of living of societies and led to the rise of a large middle class.

The dramatic rise in consumer spending further boosted production and in turn required a larger capacity to meet the growing demand. To meet this growing demand, inventors and entrepreneurs joined hands to reengineer the manufacturing processes by providing capital and a wide array of supporting equipment and tools designed not only to generate power but also to simplify each task down to a short time cycle.

THE FACTORY SYSTEM AND QUALITY CONTROL

The Industrial Revolution ushered in a new era in the system of quality control. Previously, under the craft system, the craftsman performed all the tasks of a production cycle. He was fully aware that the quality by which each task was performed had an impact on the quality of performance of subsequent tasks. In Juran's words, the craftsman was his own customer over and over again.[16] Under the factory system, however, the workers' main responsibility was "to make it like the sample" instead of satisfying the buyer with whom they had less contact. Factory workers rarely had a chance to receive feedback from buyers or users of the product to improve their work performance. It seemed that the basic economic tenet of the time was simply to boost production and secure larger markets.[17]

Concerning some quality problems caused by mass production during this era, Juran stated:[18]

Products that consisted of bits and pieces demanded that those bits and pieces be interchangeable. Then, with the growth of technology and of interstate commerce, there emerged the need for standardisation as well. All this required greater precision throughout – machinery, tools, and equipment.

Reilly pointed out that in the early nineteenth century "quality was not among the foremost of issues" especially when a century earlier, certain commodities were scarce and available only to a privileged few. Suddenly the onset of mass production brought these same commodities within the reach of the masses. The skyrocketing demand for such commodities, which were so useful in daily life, overshadowed any issues of marginal quality. Moreover, workers were so preoccupied with the intolerable working conditions imposed upon them by the capitalists that they had little time to think about quality.

Certain factory quality problems could have been avoided if the planning of the manufacturing processes had been done by supervisors schooled in process and product variation and in sampling techniques designed to assess process stability and capability. Use of these concepts, however, did not become popular until the twentieth century when statistical process control became widely used. In the absence of this knowledge, factories relied mainly on inspectors to catch defective goods during the production process.\

QUALITY IMPROVEMENT UNDER THE FACTORY SYSTEM

According to Juran, there are two kinds of quality improvement.[20] The first kind is aimed at increasing customer satisfaction by means of product and process innovation. Product innovation consists of new and improved product features to customers. Process innovation, on the other hand, makes possible the production of these new and improved features. The second kind of quality improvement is aimed at reducing customer dissatisfaction by reducing chronic waste which includes scrap and rework, inspection and test, product failures, and so on.

While quality improvement through product and process innovation gained headway during the Industrial Revolution, reduction of chronic waste did not. This could be attributed to the industrial managers' emphasis on increasing income rather than reducing waste and the guilds' policy of solidarity, which tended to stifle quality improvement.

THE SYSTEM OF SCIENTIFIC MANAGEMENT

Frederick W. Taylor pioneered the system of scientific management in the late nineteenth century. He spent more than twenty-five years of his life exploring ways to improve productivity and create the model factory of the future.[21] An engineer by profession, Taylor developed a series of concepts that laid the foundation for work improvement in the twentieth century.[22] He favoured the reduction of each job into its most minute, specialised tasks with each task handled by different individuals. To achieve efficiency and productivity, Taylor separated planning from execution.

He placed planning in the hands of the engineers and allowed shop supervisors and workers to handle the implementation. While Taylor's system was remarkably successful in raising productivity, it seemed to have neglected the human relations factor and product quality. Ignoring the human relations problem, managers addressed the problem of product quality by creating inspection departments to monitor the quality of finished products and to ensure that no defective goods reached the hands of the consumer.

Taylor gave formal credibility to the concept of scientific management by the publication of his *Principles of Scientific Management* in 1911. Before his death in 1915, Taylor began to recognise that human motivation, not just engineered improvements, could also increase output.[24] He shifted his focus from individual parts to a systems approach to managing productivity. Unfortunately, with his passing in 1915, the scientific management movement lost any chance of reaching its true potential as the precursor and catalyst for the future total quality management system. Nevertheless, the system of scientific management has laid the foundation for a management system and philosophy that would soon become the guiding force for successful organisations of the future.

QUEST FOR QUALITY IN THE TWENTIETH CENTURY

Juran cited the following major forces that demanded a modern quality revolution:

(a) Greater complexity and precision of products,

(b) Threats to human society and health, and to the environment,

(c) Government regulation of quality,

(d) The rise of the consumerism movement, and

(e) Intensified international competition in quality.

Rapid advances in science and technology brought a host of benefits to human societies. New industries arose to exploit the potential of these new technologies. These technological advances, however, demanded a more complex and sophisticated design and a more precise execution. Consumers welcomed the new and more advanced product features, but they were unfamiliar with the technology and the products themselves. Some of the new products posed potential hazards to safety, health, and the environment. When they failed in the field, consumer encountered difficulty seeking help or compensation from the system due to unclear warranties and/or poor service. In many cases, consumers were unable to protect themselves against the dangers inherent in many products. While individually the consumers could not fight the system, they, collectively, could deal more effectively with these problems. These conditions gave birth to the consumerism movement, which succeeded in persuading the government to legislate laws to protect consumers. Meanwhile, the explosive growth in science and technology and the consolidation of quality concepts espoused by various quality gurus intensified global competition in quality. The Japanese experience was the most spectacular demonstration of this power of competition in quality.

THE PRE-WORLD-WAR-II YEARS

The statistical quality control era effectively began with the publication of G.S. Radford's *The Control of Quality in Manufacturing*.[26] Radford's solution to the quality problem was to install inspection in production systems to assure uniform quality in products going to consumers. It called for the appointment of quality assurance inspectors to "examine, weigh, measure, and test every product prior to its exit from the factory".[27]

THE SHEWHART SYSTEM OF QUALITY CONTROL

Shewhart's pioneering works led to concepts of statistical quality control and laid the foundation for the "germ theory of management".[28] His works on variation and sampling and his teachings on the need for documentation had a monumental influence on the course of industrial history.[29] Shewhart developed the control chart in 1924 to deal with the issue of variation shifting the emphasis from costly correction of problems to prevention of problems and improvement of processes. He also invented the plan-do-check-act (PDCA) cycle, which is a repetitive process of study that may be applied to experiments or system improvements.[30]

THE POST-WORLD-WAR-II YEARS

Prior to World War II, the main focus of quality control was the control of variation based on the work of Shewhart. The Shewhart's system, however, was limited to the technical aspect of total quality. It would take the contributions of Sarasohn, Deming, Juran, Feigenbaum, Ishikawa, and other experts to transform the quality concept from a mere technical system to a broader body of knowledge known as total quality.

QUALITY REVOLUTION IN POST-WAR JAPAN

After the Second World War, Japan faced a daunting task of rebuilding its economy. It turned to the export sector for solutions. The Union of Japanese Scientists and Engineers (JUSE) was formed with a mandate to improve drastically the quality of Japanese exports. Japan turned to the West for help. A number of individuals went to Japan to assist in the transformation of its electronics and telecommunications industries. Among the pioneers were W.S. Magill and Homer Sarasohn. Magill was regarded as the father of statistical control in Japan. Sarasohn, on the other hand, worked with Japanese supervisors and managers to improve the reliability and yields of the electronics industry. In the late 1940s, W. Edwards Deming went to Japan to teach applied statistics in the area of surveys. From 1950 to 1952, he lectured on statistical quality control and quality management. In 1954 and 1958, Joseph M. Juran and Armand Feigenbaum visited Japan respectively to assist Japanese leaders in restructuring their industries. In just a few decades, Japan rose to industrial pre-eminence largely due to its almost fanatical dedication to quality and customer satisfaction.

THE ROLE OF QUALITY LEADERS

Many individuals were instrumental in developing, implementing, and teaching this new approach to managing an organisation. Many of the quality pioneers labored painstakingly in getting business and governmental leaders to adopt the new philosophy. Despite a slow start, their teachings gradually became more prominent as the subject of managing for quality moved to centre stage.

William Edwards Deming

W. Edwards Deming was the world-class management consultant who helped the Japanese industries learn the new principles of management, which revolutionised their quality and productivity.[31] His approach to quality is summed up in his so-called "Fourteen Points"[32] of management or in his "System of Profound Knowledge".[33] The fourteen points were drawn to tackle head-on the diseases plaguing North American industry.[34] They stress the responsibility of top management to exercise leadership for the comprehensive and constant improvement of the system and the continuous development of people as individuals and teammates.[35] Deming himself stated in 1992 that the fourteen points all had one aim: to make it possible for people to work with joy.[36]

Joseph M. Juran

In 1954, at the invitation of the Union of Japanese Scientists and Engineers (JUSE), Juran went to Japan to assist Japanese leaders to "adapt the quality concepts and tools designed primarily for the factory into a series of concepts that would become the basis for an overall management process".[37] Juran defined quality as "fitness for use as perceived by the customer." His greatest contribution was his ability to take the subject of quality beyond the technical aspects of quality control into the management arena.[38] It was Juran's view that the bulk of responsibility for success or failure in getting quality right lies with management. In order to introduce quality into an organisation, one must start at the top. He stressed, however, that "there is no such thing as improvement in general".[39] Quality improvement must take place project by project and in no other way.

Armand Feigenbaum

Feigenbaum promoted the concept that every function within the organisation is responsible for quality. Promoting cooperation and harnessing everyone's contribution leads people to have a greater sense of belonging to the organisation and generates more creativity.[40] Quality is therefore an "issue for all functions and activities".[41] Feigenbaum was credited to have originated the "cost of quality concept" as a way of measuring the benefits of adopting the total quality management approach.[42]

Philip Crosby

Crosby's philosophy is encapsulated in four quality management essentials, which he calls the "Four Absolutes of Quality"[43]: (a) Quality is conformance to requirements, not goodness or elegance; (b) The system of quality is prevention, not appraisal or inspection; (c) The performance standard is zero defects, not "that's close enough"; (d) The measurement of quality is the price of non-conformance or the cost of quality, not quality indices.

Kaoru Ishikawa

Ishikawa is considered as the "father of quality circles" in Japan. The success of quality circles could be attributed in part to the use of innovative tools by all workers to analyse and solve problems. One such tool is Ishikawa's cause and effect diagram, sometimes called the fishbone diagram because it resembles a fish skeleton.[44] This quality improvement tool, which was invented by Ishikawa in 1943, is the most widely taught and practiced technique for analysing the causes of a known effect.

Genichi Taguchi

Under the Taguchi approach, quality is defined and evaluated via a "quality loss function". Taguchi defined this loss as "costs incurred or profits foregone relative to some baseline of performance".[45] Quality loss is measured as a function of the deviation from a specified target or from an ideal performance level and is expressed in terms of monetary units. All quality improvements are evaluated in terms of cost savings they generate such that cost and quality improvements become the same. Overall, Taguchi's philosophy recognised quality as a societal issue and not just an organisational one.

William E. Conway

Conway taught that quality is a result of "the development, manufacture, administration, and distribution of consistent low-cost products and services that customers want and need".[46] He also taught that quality management is about constant improvement in all business operations including suppliers and distributors. As a top manager himself, Conway understood the importance of quality from a different perspective. He called his approach to quality "the right way to manage" and "a new system of management".

Shigeo Shingo

Shingo advocated that errors be identified as they happen and be corrected right away before serious damage occurs. Like Crosby, Shingo proposed his version of zero defects known as "Poka-Yoke" or "defect = 0." He pushed the idea that errors must be identified and handled rigorously and thoroughly as they occurred.

Masaaki Imai

His most influential book is *Kaizen* which was published in 1986. *Kaizen* consolidates the management philosophies, theories, and tools that have been developed in Japan over the years under the "Kaizen umbrella." Kaizen is considered one of the single most important factors behind the Japanese industrial success. The term means "ongoing improvement involving everyone from the top managers to the workers".[47]

Shigeru Mizuno

Mizuno concentrated on defining clearly and systematically the steps to the practical implementation of quality management. An example of such work is his book *Company Wide Total Quality Control*, which was first published in Japan in 1984.

James Harrington

Harrington taught that a quality programme would only succeed if it becomes the predominant way of life in the organisation. Like Conway, he also emphasised the important role of management in improving quality. He especially considered the key role of the first-line supervisor in the successful implementation of any quality improvement programme.

Richard J. Schonberger

In his best-selling book *Japanese Management Techniques*, he powerfully argued that the Japanese economic miracle had little to do with the national culture. The techniques used by the Japanese could easily be adopted outside of Japan. Schonberger maintained that in order to succeed modern business must be able to respond to changing market needs. He showed how industries and businesses can apply "the lessons of simplicity" to improve production and cut manufacturing lead times.

THE GURUS' COLLECTIVE WISDOM

The quality gurus came from different backgrounds and interests and worked in different situations and periods. These factors account to some extent for the differences in the way their ideas, philosophies, principles, and methods have developed. Some have focused on the technical side of quality while some have contributed to the human dimension of quality management.[48] Their methodologies and approaches to implementation "can sometimes resemble a number of pharmaceutical companies offering different cures for the common cold".[49] However, in the broad philosophies of all the gurus, there is a common thread. Despite the differences, there are concepts that are common to all of them. Macdonald and Piggott summarised these concepts as follows:[50]

1. Top management must lead in the change process.
2. The change process requires a cultural transformation.
3. Quality is integrated into all functions and not regarded as a separate function.
4. People, not machines, are the driving force behind quality.
5. Quality requires participation from everyone in the organisation.
6. Motivation alone does not engender change although it is important.
7. Company-wide education and training is essential for long-term improvement.
8. Continuous improvement demands commitment and singleness of purpose from top management.

Tenner and DeToro gave a very good exposition on the gurus' common teachings.[51]

The common thrust behind the teachings of each of these quality gurus is the concept of continuous improvement. Although their approaches differ in technique, emphasis, and application, the objective is the same – continuous improvement of every output, whether it be a product or a service, by removing unwanted variation and by improving the underlying work processes.

THE STATE OF QUALITY IN THE 21ST CENTURY

According to Juran, the modern quality movement has only been around for decades.[52] Thus, it will probably take many more decades if not a whole century for this discipline to mature. Juran believes that the evolution of managing for quality will likely follow the path of other disciplines like finance and accounting which, after centuries of development, have already gained a greater state of maturity.

According to Conti, Kondo, and Watson, "quality is becoming an integrated system where the best of all approaches are merged into unique quality systems that engage the entire business, rather than a single function."[53] The current state of quality can be described in terms of three variants: compliance-oriented, improvement-oriented, and business-management oriented. These variants, which need to coexist, must be managed well in order for the organisation to succeed.

Compliance-Oriented

This picture of quality focuses primarily on meeting specifications, developing procedures, providing documentation, and ensuring consistency. It also involves establishing standards based on customer requirements, needs, and expectations, and ensuring that these standards are met, current nonconformance corrected, and potential future nonconformance prevented. Customer-oriented quality is often applied to manufacturing although it can also be applied to service industries. It developed with the introduction of statistical quality control (SQC) and statistical process control (SPC).

The primary goal of SQC is to monitor and control variation in the product being produced and, in the service, being provided.[54] It relies on statistical charts to monitor and control product variables and on acceptance sampling to replace one hundred percent inspection. SPC, on the other hand, focuses on the prevention of defects by applying statistical methods to control the production process. This shifts the emphasis from utilising statistical control methods to inspect or detect poor quality to using them to prevent poor quality. With prevention, the process, rather than just the product, is monitored, controlled, and adjusted to ensure correct performance. The responsibility for quality falls on the designers and manufacturers instead of inspectors. SQC also seeks to produce parts as close to the "nominal" values as possible instead of simply trying to meet specification limits. In the service sector, SQC strives to provide services of consistent quality from customer to customer.

Improvement-Oriented

Improvement-oriented quality, also known as Total Quality Management (TQM), emphasises continuous process and system improvement to achieve customer satisfaction and ensure long-term organisational success. It promotes an integrated process improvement approach involving all the departments of the organisation. It involves problem prevention, process improvement, and a team-based approach to problem solving and product improvement. The TQM approach encourages a long-term, never-ending commitment to process improvement. It is adaptable as it seeks to meet the changing needs, requirements, and expectations of customers. Improvement-oriented quality has a wide range of applications from manufacturing, to service, and to support operations.

Business-Management Oriented

This form of quality calls for an integrated deployment of strategy and careful attention to critical success factors. This orientation, which is broader in scope, encompasses the other two described above. It requires a comprehensive vision of the business, and a broad understanding of its markets, its core processes, its value chain, and its key success factors. Business management oriented quality calls for the genuine involvement of top-level management and every employee in integrating continuous improvement efforts into everyday business activities. This involves developing the mission statement to support the organisational vision, which provides the basis for subsequent strategies, objectives, and decisions.

QUALITY SYSTEMS AND QUALITY AWARDS

Building and sustaining quality organisations require a solid foundation. Designing an effective organisational structure calls for an understanding of best practices, a solid, process-oriented quality assurance system, and a process of continuous evolution toward high-performance management practices.[55] A quality management system, thus, contains necessary ingredients that "enable organisational employees to identify, design, develop, produce, deliver, and support products or services that customer wants".[56]

The systems approach teaches that customer satisfaction can only be achieved if all areas of the organisation work together. Moreover, achieving customer satisfaction depends not only on how well and how thoroughly quality actions in the several areas of the organisation work individually but also on how well and how thoroughly they work together.[57]

ISO 9000

ISO 9000, originally published in 1987, is one of the best-known quality management systems certifications in the world. Its focus is for companies to document their quality systems in a series of manuals to facilitate trade through supplier conformance. ISO standards provide a baseline against which an organisation's quality can be judged via multidisciplinary participation in quality-improvement efforts, documentation of systems and procedures, and the basic structural elements necessary for quality systems. They are based on the premise that certain generic characteristics of management practices can be standardised, and that the quality system will provide confidence that the outputs will meet customer expectations and requirements. The ISO prefix comes from *iso*, which is a scientific term for equal. ISO certification means that an organisation is assured to have quality equal to its peers. The ISO standards define quality assurance at three levels. Level 1 (ISO 9001) is applicable to firms that design, develop, produce, install, and service products. Level 2 (ISO 9002) applies to firms engaged only in production and installation. Level 3 (ISO 9003) applies to those engaged only in final inspection and test.

ISO 9000, on one hand, describes the key concepts of quality assurance which include the objectives and responsibilities for quality, stakeholder expectations, the concept of a process and its role in a quality system, the roles of documentation and training, and the application of different standards. ISO 9004, on the other hand, guides the development and implementation of a quality system. The latest revision to the ISO standards, which is currently known as ISO 9000:2015, provides a recognised international quality standard that businesses can follow. Companies seeking ISO certification document their systems in a series of manuals to facilitate trade through supplier conformance.

For ISO 9000, documentation and record keeping are very important. Some examples of these records may be employee training records, procedures, policies, instructions, process control charts and capability records, and so on. Sound documentation ensures that work is performed consistently and the causes of poor quality determined and corrected. Excellent record keeping helps to maintain product or service quality by providing records that are easy to retrieve, legible, appropriate, accurate, and complete.

Organisations seeking ISO certification must prove compliance with the ISO 9001 standard, which is certified by an accredited, independent ISO 9000 registrar. It is the work of the registrar to conduct a thorough audit of the applying organisation to verify that it indeed meets the requirements as set forth in ISO 9001. Once an organization has been certified, surveillance audits are conducted, often unannounced, and often every six months, to ensure continued compliance.

As an international quality management system, ISO 9000 has its share of limitations. Obtaining certification can be time consuming and costly. Depending on the current state of the organisation's quality system, certification may take several thousand employee-hours and thousands of dollars. Its adoption and implementation can be hindered by a number of factors, including insufficient management involvement in the process, inadequate resources, lack of an implementation plan, or lack of understanding of ISO 9000 and its benefits. Nevertheless, ISO 9000 has also produced some major benefits. One of these is that ISO has pushed almost everyone in the organisation to be concerned with and to be accountable for quality. Quality, which used to be the domain of the quality manager, has now become the responsibility of all personnel. The main purpose of the ISO 9000 standards is to achieve an effective management system that focuses on continuous improvement, communications, and meeting customer requirements.

ISO 14000

Established in 1996, ISO 14000 is a series of standards intended to promote a common approach to environmental management and help organisations attain and measure improvements in environmental performance.[58] It provides guidelines and a compliance standard.[59] The compliance standard is named ISO 14001 which provides the basis for developing a comprehensive environmental management system. The process for documenting the elements of ISO 14001 and seeking certification is similar to that of ISO 9000:2015. Just like in ISO 9000, an important part of the process in ISO 14000 is the selection of the appropriate registrar.

ISO/TS 16949

Established in 1999, ISO/TS 16949 was designed to define automotive industry standards worldwide. It "specifies the quality system requirements for the design/development, production, and, where relevant, installation and servicing of automotive-related products".[60] It is closely aligned with ISO 9000:2015 and is founded on a systems view of automotive production. ISO/TS 160949 consists of the following sections: management responsibility, resource management, product realisation and measurement, analysis and improvement.

Lean Production and Lean Enterprise

The concept of lean production (a.k.a. just-in-time) can be described from both a philosophical and from a systems point of view. From a philosophical view, lean can be defined as waste reduction. Anything in the process that does not add value to the customer should be eliminated. From a systems viewpoint, lean is a group of techniques or systems focused on optimising group processes. This view is exemplified by the lean production system initially developed and refined by Toyota Motor Company.

The focus is to "get more with less" by eliminating "waste in all forms, including defects requiring rework, unnecessary processing steps, unnecessary movement of materials of materials or people, waiting time, excess inventory, and production".[61] Overall, lean production focuses on optimising processes through the philosophy of continual improvement.

Lean production enables the company to "become vastly more flexible and responsive to customer desires".[62] Implementing lean production requires a huge amount of detailed planning, discipline, hard work and painstaking attention to detail. It is facilitated by a "focus on measurement and continuous improvement, cross-trained workers, flexible and increasingly automated equipment, efficient machine layout, rapid setup and changeover, just- in-time delivery and scheduling, realistic work standards, worker empowerment to perform inspections and take corrective action, supplier partnerships, and preventive maintenance.[63]

Quality experts believe that the next step in achieving superior performance is to go beyond lean production by linking individual lean activities up and down the value chain to form a continuous value stream that creates, sells, and services a family of products. This involves the creation of a lean enterprise, which is nothing more than a group of individuals, functions, and legally separate but operationally synchronised companies. The manager of a lean enterprise must know how to manage the conflicting needs of individuals, functions, and companies. For instance, at the individual level, most people equate having a job and a career with self-respect and financial well-being. It is therefore ridiculous to assume that they will accept any changes that will eliminate their jobs. Because lean activities often result in excess number of employees, the jobs problem becomes a major obstacle for any enterprise that attempts to achieve and maintain a superior level of performance. At the functional level, it is generally recognised that functions are places where knowledge is accumulated, taught, and improved. In a learning organisation, they are where learning is collected, systematised, and deployed.

Because of the depth of knowledge that is required and the time and effort needed to obtain that knowledge, functional specialists are often more committed to their function than to the enterprise as a whole. At the company level, organisations are often preoccupied with survival and the need to make an adequate return. When faced with hard times, these organizations often tend to gravitate toward control rather than efficiency and customer responsiveness.

The lean enterprise can address the conflicting needs of individuals, functions, and companies

(a) by offering employees career paths that alternate between concentration on a value chain and knowledge building within functions;

(b) by turning functions into schools; and

(c) by focusing organisations on a narrow set of tasks and implementing a new code of behavior to keep their members in line.

As much as possible, organisations must explore every option to preserve jobs as they create lean enterprises. Womack and Jones[64] believe that creating lean enterprises and finding new tasks for excess employees is better than any industrial policy that the government could ever devise.

Six Sigma and Lean Six Sigma

Six Sigma, pioneered by Motorola in 1982, is generally considered more of a business strategy than a quality programme.[65] It consists of a "well-thought-out packaging of quality tools and philosophies in an effort to provide rigor and repeatability to quality improvement efforts".[66] Its focus on cost reduction and profits sets it apart from traditional continuous improvement and makes it very popular with top management. Six Sigma is organised around creating champions (responsible for management and guidance), master black belts (advanced training in one or more specialties), black belts (skill-building tools/methods course), green belts (introductory methods/tools course), yellow belts (introductory methods/tools course), and white belts (an awareness course).

Six Sigma can be defined in four different ways. First, as a metric, it can be considered as a statistical measure of process performance. The Six Sigma methodology is based on the value (6σ) used to calculate process capability, C_p. C_p = (USL-LSL)/ 6σ, where USL is the upper specification limit while LSL is the lower specification limit. When C_p = 2.00, Six Sigma has been achieved. Operating at a Six Sigma level enables an organisation's production to have virtually zero defects (long term expectation for the number of defects per million opportunities is 3.4 units). Some of the benefits of Six Sigma are robust designs, radically lower defects, and lower costs of poor quality.

Second, Six Sigma can be considered a methodology which combines rigorous statistical analyses of problems with a host of statistical tools to address a variety of problems, to reduce variation, and to optimise and control process output. While none of the statistical tools used are new, what is new is how these tools are packaged and deployed in the organisation.

About 90% of quality problems can be handled by the basic tools of quality, however, the next 10% requires advanced training and analytical techniques which a Six-Sigma program can provide.

Currently, the tools that are being integrated into Six Sigma are those that were once associated with Japan's lean management processes. Third, Six Sigma can also be considered as a philosophy of management which links improvement targets to both an organisation's strategy and its business results. It has evolved into an organisation-wide programme for improvement involving hierarchical training, organisational learning, and pay for learning. Fourth, the Six Sigma process can become part of an organisational culture that promotes near-perfect performance in organisational processes. While it started as a single firm's approach to reduce costs and improve quality, Six Sigma today means much more as it "involves planning, organisation, training, human resources planning, and pay for knowledge".[67]

Its supporters believe that this new methodology will help reinforce the "total" in total quality management by assuring that quality management will find its way into all areas of the organisation. Six-Sigma's focus on cost-reduction and profit has made it so popular with the world's top managers – an accomplishment that is difficult to achieve and one that perhaps will have a long-lasting impact on business thinking.

Implementing Six Sigma involves four major processes: change management, innovation, problem-solving and project management. Change management emphasised accountability for results, measurement, and management by fact. The Six Sigma innovation process is also known as Design for Six Sigma (DFSS) the overall objective of which is to design products, processes, or services that consistently meet customer expectations. DFSS requires either the DMADV (design, measure, analyse, design, verify) process or the IDOV (identify, design, optimize, verify) which focuses more on final engineering design optimisation. The problem-solving process requires the DMAIC (define, measure, analyze, improve, control) methodology. When DMADV or DMAIC are employed to manage project reviews, then an organisation has taken the step towards project management.

The latest development in the evolution of quality management is the development of Lean Six Sigma – the integration of lean production methods with the Six Sigma methodology. Some people consider Lean Six Sigma as an improvement method because it uses data to eliminate and eliminate process problems. Others consider it an improvement engine because it establishes a whole new set of rules and procedures within an organisation to continuously generate quality results.

According to George, Rowlands, and Kastle,[68] the goal of Lean Sigma is to enable organisations to delight their customers (delivering higher quality product in less time) by improving their processes (eliminating any defect or anything that was unacceptable to a customer) through teamwork (sharing of ideas with team members) and data-based decision making (all decisions are based on data).

Malcolm Baldrige National Quality Award

The Baldrige Award was established in 1987 by the United States Congress to set a national standard for quality excellence. Its principal focus is on promoting high-performance practices that leads to customer satisfaction and organisational results. The award is designed to "promote awareness of quality as an increasingly important element in competitiveness, understanding of the requirements for quality excellence, and sharing of information on successful quality strategies and the benefits derived from the implementation of those strategies".[69] Originally, the award has three eligibility categories: manufacturing companies, service companies, and small businesses. In 1999, eligibility was expanded to education and healthcare. In 2005, it added a government and nonprofit category.

The award examination is based upon a rigorous set of criteria which consist of seven major categories: (1) leadership, (2) strategic planning, (3) customer focus, (4) measurement, analysis, and knowledge management, (5) workforce focus, (6) operations focus, and (7) results. These categories form an integrated management system to achieve performance excellence. The Baldrige criteria are built upon a set of core values and concepts, which integrate overall customer and company performance requirements. Examples of these values are as follows: customer-driven quality, leadership, continuous improvement, employee participation and development, fast response, design quality and prevention, long-range outlook, management by fact, partnership development, and corporate responsibility and citizenship.

In recent years, the number of state quality awards has increased. Some states adopted the "full-Baldrige approach" where the full criteria were adopted but the scores required   to win the awards were lower. Other states have taken the "Baldrige-lite approach" where   the criteria were used but the process application was simplified. Still other states used the "multilevel approach" where top level companies used the full-Baldrige criteria; the second level, the Baldrige-lite approach; and the lower levels, some sort of recognition for those firms putting forth significant effort toward improving performance.

Other International Awards

Many countries and regions of the world have established awards and awards criteria. A few of these, which will be described in this section, are as follows: European Quality Award, Canadian Awards for Business Excellence, Australian Quality Awards, and the Deming Prize.

The European Quality Award was designed to increase awareness throughout the European Community, and businesses in particular, of the growing importance of quality to their competitiveness in the increasingly global market and to their standards of life. The award consists of two parts: the European Quality Prize and the European Quality Award (now known as the Business Excellence Model). The former is given to companies that demonstrate excellence in quality management practice by meeting the award criteria. The latter is awarded to the most successful applicant. The award process is similar to the Deming Prize and Baldrige Award although it places greater emphasis on an organisation's impact on society.

The Canadian Awards for Business Excellence were designed to stimulate and support quality-driven innovation within all Canadian enterprises and institutions, including business, government, education, and healthcare. The criteria are similar in structure to the Baldrige criteria with some key differences. The major award categories are leadership, customer focus, planning for improvement, people focus, process optimisation, and supplier focus.

The Australian Quality Awards include the following assessment criteria: leadership, strategy and planning, information and analysis, people, customer focus, processes, products and services, and organisational performance. As with the Baldrige, the awards framework emphasises the holistic and interconnected nature of the management process. One of its distinctive aspects is solid union backing for the awards.

The Deming Prize, established in 1951 by the Japanese Union of Scientists and Engineers, is awarded to individuals and groups who have contributed to the field of quality control. It is awarded in three categories: Deming Application Prize for Division, Deming Application for Small Business, and Quality Control Award for Factory. Unlike the Baldrige, which has become very managerial in nature, the Deming Prize focuses more on the nuts and bolts of quality improvement.[70] Also, the latter is so focused on the statistical methods, and a complete picture of the management system may not emerge. To deal with this problem, Japan has developed another award known as the Japan Quality Award, which closely resembles the Baldrige Award.

FUTURE TRENDS IN QUALITY

In an article published in 1998, quality pioneer Armand Feigenbaum[71] explained various trends that will shape the direction of quality management in the future. He foresaw that customers on a global scale would continue to demand high quality and added value from producers of goods and services. These customers would be interested not only in the quality of the products or services provided but also in the quality of the organisations that provide them. Having an excellent product is not enough. The organisation must also provide quality services like accurate billing, reliable delivery, after-purchase support, and other services. It will need to harness the power of technology on behalf of the customer to sustain its competitiveness in the 21st century. Global economic competition will exert enormous pressure on organisations to continually improve quality while simultaneously reducing production cost and prices charged to consumers. To succeed in this environment, companies must learn to manage their budgets and know how to lead their people at the same time. This will certainly require fundamental changes in the way the organisation operates.

Given the evolution of managing for quality over the centuries, it is fascinating to identify what the next developments might be. Goetsch and Davis predict that quality management as both a practice and a profession has a bright future.[72] In fact, in terms of succeeding in the global marketplace, quality management is the future. Those organisations that fully institutionalise the principles of quality management have a strong chance of succeeding in the global marketplace now and in the future. Such companies will exhibit the following characteristics:[7]

- A total commitment to continually increasing value for customers, investors, and employees
- A firm understanding that market driven means that quality is defined by the customer, not the company
- A commitment to leading people with a bias for continuous improvement and communication
- A recognition that sustained growth requires the simultaneous achievement of four objectives all the time, forever:
    (a) customer satisfaction;
    (b) cost leadership;
    (c) effective human resources; and
    (d) integration with the supplier base
- A commitment to fundamental improvement through knowledge, skills, problem solving, and teamwork

Juran[74] believes that the evolution of managing for quality will most likely follow the path of other disciplines like finance and accounting which have already reached a greater state of maturity. Studies in these disciplines, which have taken centuries to develop, have yielded a consensus in many aspects of the field. Recent developments in managing for quality indicate some commonality with the path these disciplines have taken. It is expected that the focus on quality will continue to gain more prominence as national leaders and policy makers realise its importance to managing their respective economies. It is also expected that quality will become a significant object of study in business, government, and other not-for-profit organisations.

The new millennium, however, is going to present some significant challenges. Some say that it will bring a proliferation of ideas, innovations, and improvements.[75] Others say that it will require higher skill levels, greater gender balance, and increasing workplace diversity. Whatever the case, it is almost certain that market developments will create an ever-increasing standard of expectations and higher demands on goods and services providers. To thrive in this dynamic environment, business must continue to focus on innovation, flexibility, and speed.

We will probably see an increasing application of quality principles to information and knowledge management as quality evolves from the industrial age to the information age. We will probably see a move towards greater integration between the analytically based "systems and statistical engineering approach" to quality and the psychologically based "human relations approach".[76] Applications in business, healthcare, education, the government, and other organisations will continue to refine its methodologies and practices. Just as quality played a major role in raising Japan's standard of living after World War II, quality will play a similar role in bringing entire national economies into stronger positions in the global system of trade and commerce. In the 21st century, quality will probably be used to fight social ills and promote equal distribution of wealth and equal access to sources of progress like higher education and advanced health care. The focus will probably shift from a "single bottom line" to a "multiple bottom line" that includes not only financial results but people- and society-related results as well. To sum it up, quality will be employed to improve the social and economic lives of many in the new millennium.

- Awareness of the new importance of quality will spread to national policy makers: legislators, administrators, and economists.
- Correlations will be established between performance on quality versus financial results.
- Standardised reports will evolve to provide a summary of the quality achievement record of companies as well as their current status.
- Financial analysts will use achievements in quality as inputs for rating creditworthiness as well as for judging the financial potential of companies.
- National, industry, and other quality indexes will be evolved. One example of this is the Baldrige Index, which measures the stock market performance of all Malcolm Baldrige National Quality Award (MBNQA) winners.
- Degree-granting colleges oriented to quality will proliferate.
- The K-12 schools will evolve courses relating to managing for quality.
- Research in quality will intensify.
- Professionalism among quality specialists will grow.
- It is conceivable that future laws will extend the use of licensing in the quality field, on the ground of protecting the public interest.

The modern quality movement has only been around for decades. It still has far to go before it becomes widely effective among world economies. It will probably take many more decades, if not a whole century, for the quality management discipline to mature and for nations and economies to assimilate this change. In this regard, the twenty-first century may well become known to historians as the Century of Quality.[78]

PART II: QUALITY CONCEPTS IN HIGHER EDUCATION

Quality is an elusive concept. Its meaning varies from person to person and from organisation to organisation. However, for institutions competing in a global marketplace, it is important to define quality strategically. It is also important to remember that the meaning of quality changes with time and circumstances. It involves meeting and exceeding customer expectations and applies to products, services, people, processes, and environments. To address these definition issues, a quality framework for higher education is developed in Chapter 3.

The notion of having customers is still foreign to many campuses. Yet, it has been proven over and over again that customer-driven institutions are effective because of their ability to satisfy and anticipate customer needs. The success of higher educational institutions in the future will increasingly be determined by how effectively they satisfy their various customers. Identifying and satisfying the needs of customers will be discussed in Chapter 4. The success of meeting customer needs will be gauged by how everyone within the educational system works together to achieve the aim of the system. What is needed within the halls of academia is collaboration and transformation towards a new style of management. The subject of managing the educational system will be discussed in Chapter 5. The transformation to a new style of management requires a change in paradigms and old habits. It requires a change in roles, responsibilities, and behaviours of every organisational participant beginning with the leadership. Administrators must lead in a way that cultivates a high level of trust and respect from their subordinates. They must demonstrate commitment by consistently displaying high ethical standards and by exhibiting the willingness to make personal sacrifices to uphold these values. It is evident that moral leadership will remain as an important and critical variable for long-term business success. Quality, ethics, and moral leadership will be the subject of Chapter 6.