

Perspectives

Main schools of TQM: "the big five"

Volker Krüger

The author

Volker Krüger is General Sales Manager at Wippermann Industrial Chains Ltd, Meinerzhagen-Valbert, Germany.

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Abstract

The early development of the total quality movement was substantially influenced by only a few quality "pioneers": Deming, Juran, Feigenbaum, Crosby and Ishikawa. This article discusses their key contributions about quality. Argues that these US and Japanese quality "gurus" contributed a number of important ideas to today's understanding of total quality management (TQM). Points out, however, that TQM is not merely a set of statistical tools and methods for improving the company's product and service quality level and a quality management system like BS 5750 and ISO 9000, as suggested by these quality pioneers. TQM rather comprises a business strategy for harnessing the full capacity of all the company's resources – not only technical – in order to achieve world-class quality at minimum costs. Comes to the conclusion that the role of the human resource issue and the importance of the individual employee were hardly recognised by these classical quality "gurus".

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The globalisation currently affecting our societies has resulted in increased economic competition and a growing awareness of the value of total quality management (TQM) to success. Therefore, business enterprises have strengthened their efforts to achieve a high quality level, which has led to the recognition of quality as a key strategic factor in achieving business success.

The early development of complex quality management systems was substantially influenced by only a few American and Japanese quality experts. In the following, the work of the main five quality "gurus" will be briefly discussed: Deming, Juran, Feigenbaum, Crosby and Ishikawa. Oakland points out that it seems as if all these gurus present different solutions to the needs of quality management. In reality, they address the basic principles of total quality. "They are all talking the same 'language' but they use different dialects" (Oakland, 1989). We will, however, not present each author in depth, but will rather concentrate on the main ideas of each of the early quality experts named above.

The work of Deming

The American Dr William Edwards Deming was born on 14 October 1900. He was educated at the University of Wyoming, the University of Colorado, and then Yale University, where he received his doctorate in mathematical physics in 1928. From 1946 to his death in 1993 he was Professor of Statistics at the Graduate School of Business Administration at New York University. At the beginning of the 1940s Deming met Walter A. Shewhart, a statistician at Bell Telephone Laboratories in New York. For several years, Deming met regularly with Shewhart to discuss what Shewhart called "statistical control" and random variation of a work process. Deming began giving lectures on quality control in manufacturing environments across the USA. However, the management of the US industrial corporations responded only very reluctantly to Deming's efforts at that time. After the Second World War, US industry turned back to the peacetime production of consumer goods. There was a huge demand and basically no foreign competition. During this era of mass immigration, when the USA was

being flooded with unskilled and uneducated workers, Taylor's Scientific Management was an easy way to employ these unskilled workers in large numbers. The quality issue was not considered to be important; the volumes and quantities were crucial – and there was profit enough to cover the extra costs of non-quality.

In 1947, Deming first visited Japan and held seminars during which he developed and explained his idea of quality and economic production. Deming's ideas were very well received by Japanese managers and engineers and led the Japanese quality revolution.

Japanese manufacturers created in his honour the "Deming Prize", a prestigious quality award which is still presented annually. In May 1960, the Emperor of Japan decorated him with the Second Order Medal of the Sacred Treasure.

In 1980, when Deming was in his 80th year, his approach to quality was featured in an NBC White Paper, *If Japan Can, Why Can't We?* This programme was the beginning of the quality revolution in the USA, and Deming was, at rather long last, discovered in his own country. On 25 June 1987, the President of the USA awarded Deming the National Medal of Technology. During his lifetime, Dr Deming had no association, no institute, no organisation. He always had called himself a "Consultant in Statistical Studies". He was elected to the National Academy of Engineering and to the Science and Technology Hall of Fame in Dayton in 1986. In 1991, Deming was inducted into the Automotive Hall of Fame. Dr Deming was a perennial student of the theory of music, and wrote two masses and a number of canticles and anthems. He died in Washington on 20 December 1993.

The main thesis of Deming is: by improving quality it is possible to increase productivity, which results in the improved competitiveness of a business enterprise. According to Deming low quality means high costs which will lead to a loss of the competitive position of the business organisation in the market. The quality improvement of the company's work processes will result in less reworking and less waste of manpower; material resources and the number of errors will be reduced. The company's output will be achieved with less effort. The investments in reworking and defective parts, which are very costly, can be avoided. The lower costs will thus enable the

enterprise to have a stronger competitive market position. In order to achieve this aim Deming developed an approach which is summarised in his 14-point programme (Deming, 1982).

1. Create constancy of purpose for improvement of product and service

The starting point for the realisation of such a programme is Deming's consideration that the management of a business organisation has two sets of problems: problems of today and those of tomorrow. Problems of today encompass the immediate needs of the enterprise: the quality of the company's product put out today, sales, profits, public relations, etc. Many companies dwell on such problems, however, without sufficient attention to the future. Problems of the future concern constancy of purpose and dedication to quality improvement. Deming deplores the fact that managers tend to live and work for the next quarterly dividend only, instead of concentrating on the question of whether the company will be in business five years from now.

Therefore, establishing constancy of purpose requires the company to be innovative and to allocate the necessary resources for long-term planning. What are the future products and materials that will be required by consumers? What will be the future production method? What are the skills required, and in what number? How do we have to organise training for the workers currently employed? What will be the cost of production? How will the product and service of our company be used by the customer? Furthermore, constancy of purpose means putting resources into research and education. To be prepared for the future, the business organisation has to invest today in properly educated employees and research that will lead to product innovation. Resources are also needed for investment in maintenance of equipment, furniture, and fixtures. A business organisation cannot improve a product or work process when outdated machinery is used.

2. Adopt the new philosophy

Quality must become the new business philosophy of the company. Deming states that the company can no longer live with commonly accepted levels of mistakes, defects, bad materials, poor training,

uninformed workers and inattentive service. Management has learnt to live in and accept a world of errors and defective output. These are "roadblocks" to better quality. Therefore, according to Deming, "it is time to adopt a new religion". A new approach to quality is required where mistakes and defects are considered to be unacceptable.

3. Cease dependence on mass inspection

Many companies inspect a product as it comes off the production line, and defective parts are either reworked or thrown out. This 100 percent inspection is too late, ineffective, and costly. Deming notes that quality does not come from inspection, but from improvement of the company's work processes. The traditional way of post-production inspection was to "inspect bad quality out". Deming's new demand is to "build good quality in". The 100 percent post-production inspection syndrome should be eliminated and replaced by an improvement of the work processes of the enterprise.

4. End the practice of awarding business on price tag alone

Deming stresses the fact that the purchase price has no meaning without the measure of the quality of this item. Companies tend to award business to the lowest bidder only. A large proportion, however, of the problems of poor quality result from the poor quality of incoming materials. Instead, companies should look for the best quality. This quality level can be achieved by co-operating with a single supplier in a long-term business relationship where both partners have the chance to work very closely together.

5. Constantly and forever improve the system of production and service

Quality improvement is an ongoing, never-ending process, and not a one-off effort. Management must continuously reduce waste and improve the quality of every activity in the company. This includes all functions, such as procurement, engineering, transportation, sales, methods of distribution, accounting, service to customers, etc.

6. Institute modern methods of training on the job

According to Deming poor training of workers appears to be a way of life. A worker learns his job from another worker. This

worker, however, was never trained properly. Therefore, Deming demands that training must be completely reconstructed. Deming suggests using his statistical control charts: when the output of the work process for which the worker is responsible reaches a statistically stable state, additional training will not help the worker.

7. Institute modern methods of supervision

It is the responsibility of top management, Deming argues, to discover and remove possible problems that make it difficult for the worker to take pride in what he does. These barriers could be, for instance, a deaf ear to his suggestions for improvements in the work process, machines which are not properly maintained, an emphasis on numbers and not on the quality of output, poor quality of incoming raw materials, and too much time spent on reworking. Instead of imposing quotas on the worker, the supervisor should rather help him to do his job correctly. It is the responsibility of the supervisor to help, to lead, and to coach the worker. The traditional approach of supervision working with elements such as pressure and distrust is no longer required.

8. Drive out fear

Many workers are afraid of asking questions of their supervisors, even when they do not understand their task properly and do not know what is right or wrong. Deming argues that the economic loss from fear is appalling. The worker is afraid to point out a problem for fear he may be blamed for the problem. The worker is concerned that his superior will feel threatened. It is the responsibility of management to generate a cultural atmosphere in the company which makes sure that workers are not afraid to express their ideas, not afraid to ask questions, not afraid to make suggestions for quality improvement, not afraid to request further instructions, not afraid to report raw material which is not usable because of poor quality. Only a positive quality culture where every employee feels free to contribute his ideas will allow the company to achieve its quality objectives.

9. Break down barriers between staff areas

Often staff areas do not work closely together, but rather compete with each other. The flow

of communication between different departments of the same company is often very poor. Information is not exchanged openly for the best of the company but is considered to be the sole property of one department. Each staff area is sub-optimising its own work only. Today's customer requirements and the highly competitive international markets are very complex, and it requires using the total expertise from all the company's different departments to solve a particular quality problem. Only the team approach will enable the company to satisfy the customer. Deming notes that "teams composed of people in design, engineering, production, and sales can accomplish important improvements in design of product, service, and quality, and reduction of costs".

10. Eliminate numerical goals for the workforce

Slogans, pictures, and posters for the workers which urge them to increase productivity, according to Deming, must be eliminated. Defining a goal without the necessary method for achieving it is useless, Deming argues. Setting the numerical goal without the description of how to reach it is a common practice among managers. These slogans and goals never help the worker to perform a good job. They have a "lofty ring", Deming states, and it is almost impossible for a worker to do a quality job when the incoming material is off-gauge, off-standard, or otherwise defective. Management must therefore provide the means to the ends that it proclaims.

11. Eliminate work standards and numerical quotas

Quotas and other work standards impede quality probably more than any other single working condition. He emphasises that a qualitative target is superior to a quantitative one and that all activities relevant to quality should be orientated to the long term and not the short term. Once a worker has completed his quota for the shift, he quits working and lingers around till the end of his shift.

Moreover, the pressure to achieve certain quotas will take account mainly of numbers, and not quality. Deming refers to the example of a steel company where the incentive pay was based on the total tonnage turned out, regardless of how much of the product was turned back into the furnace as unusable.

12. Remove barriers that hinder the hourly worker

Employees are basically eager to do an excellent quality job. Too often, however, wrong supervision, poor quality of raw materials, and faulty equipment hinder the workers and are barriers that must be removed by management. Workers are frustrated because they are sometimes unable to perform their jobs the way they would like. Supervisors, Deming argues, might only be interested in getting the work out, not the quality of the work. They put pressure on the worker and request him to meet his quotas which limits the right of this worker to be proud of his work. Deming notes:

The hourly worker is deeply aware of the need for quality. To him, quality means his job. He also understands why productivity increases as quality goes up. He cannot understand why the management talks about quality but does nothing about it – in fact, impedes it. The fact is that management can have both quality and numbers by providing road maps to quality and eliminating barriers that confront the hourly worker.

It is the responsibility of management to remove those barriers.

13. Institute a vigorous program of education and training

All employees, Deming notes, should be trained continually as the needs of the customers are constantly changing over time. It is not enough to hire good people for the business organisation. They constantly have to acquire new skills for new materials and new methods of production. Deming considers training to be a long-term investment in people and the future of the company. Continuous training helps employees to improve their quality performance and the quality of the work processes they are responsible for. Deming stresses particularly the need for training in statistical techniques, such as the use of control charts. A company should be in the position to fall back upon trained personnel who are able to apply statistical techniques efficiently.

14. Create a structure in top management that will push every day on the above 13 points

The final aspect of Deming's programme is his consideration that management of a business enterprise has to define an overall

quality framework, which allows for the successful implementation of and compliance with his previous 13 points. Management is required to organise itself as a team to advance Deming's 13 points. Deming suggests using an external statistical consultant for guidance.

However, Deming does not consider certain aspects of today's TQM approach, such as the need to give more recognition to the requirement to positively motivate the individual employee to dedicate himself to quality work. The role of the human resource issue and the vital contribution that the individual can make to his work organisation were not covered by Deming. Deming ignores the question of commitment and motivation of the individual employee. Despite the attempt to recognise a holistic quality management system in the work of Deming, it has to be pointed out that statistical methods remain the heart of his ideas.

The work of Juran

Along with Deming, Dr Joseph Moses Juran (1904) lectured in the 1950s in Japan. He was the first to broaden the understanding of quality control, emphasising the importance of the managerial aspect. His work is very detailed and comprehensive. It has to be pointed out that Juran published the first edition of his *Quality Control Handbook* as early as 1951 which highlights the importance Juran has received for his contribution towards our understanding of TQM.

Juran was born in Romania. At the age of eight he emigrated with his family to Minneapolis in the USA. In 1924, after having obtained a degree in electrical engineering, Juran started at the Hawthorne Works of the Western Electric Company. He was assigned to investigate internal and external quality complaints. Various production departments were from time to time not able to perform their tasks properly because of the poor quality of components and their inability to assemble parts. It was Juran's job to find the possible causes and to apply a remedy. Then, in 1926, the Western Electric Company was urged by Bell Telephone Laboratories to apply some statistical tools, including the newly invented Shewhart Control Chart. Subsequently, a new department was created – the so-called

"Inspection Statistical Department" – and Juran became one of its team members. At the end of the Second World War, Juran decided to embark on a new career of freelancing in the area of consulting and management. In 1951, he published his first edition of the *Quality Control Handbook*. As a direct result of the publication of this book, Juran received the original invitation to visit Japan from the Union of Japanese Scientists and Engineers.

Juran conducted a number of seminars for top and middle managers. His lecturing had a clear managerial flavour. Juran's main contribution was: quality control must be conducted as an integral part of the management function.

Juran deplored the fact that with the Industrial Revolution and the strong growth of business enterprises using mass production methods, large companies were more and more split into functional departments. Many industries adopted the principle of separating planning from execution. The planning of various functions in the company was delegated to specially trained planning departments, whilst the task of the actual execution of the plans was left to the company's supervisors and workforce. As business enterprises grew further in size, the volume of activity outgrew the capacity of the company's management. It thus became increasingly necessary for management to delegate. Juran argues that once managing the quality issue was delegated to the subordinate hierarchy, it was no longer considered to be vital for the top management of the company to participate personally in managing quality. This progressive removal of the company's management from managing the quality issue led to negative effects on quality. In the end, nobody in the company felt responsible for quality. Since the worker, however, orientates himself towards the supervisor, the supervisor in turn to the department manager, and the department manager to the board of directors, the visible leadership and personal involvement of top management in inspiring quality, as Juran explains, is a very important signal for every employee in the business organisation.

The involvement of management can become visible in various ways:

- It is the responsibility of management to establish a Quality Council. This council plays the central role in co-ordinating the company's various activities regarding

quality; for instance, quality improvement teams, TQM awareness activities and training programmes.

- Moreover, management should establish a Quality Policy. Quality policies are guides to managerial actions. The management of the company has to identify the need for quality policies, to assign the responsibility for preparing a draft, to review the draft, to approve the final version, and to implement the quality policy.
- Furthermore, management has to establish quality goals which should be expressed, Juran argues, in numbers and should include a time frame. An example could be: within the next three years, the internal failure costs of the machine shop, which result from discrepancies detected prior to delivery to the external customer, shall be reduced by 40 percent.
- Once a specific goal has been established by management, it is then the responsibility of management to provide the necessary resources needed to achieve the quality goals. This could mean additional training for some employees, monetary funds to improve a certain situation and time to work within a quality improvement team.

We can see from the above that Juran's approach, namely that quality control has to be conducted as an integral part of the management function, broadened the understanding of quality at that time.

The work of Feigenbaum

Dr Armand Vallin Feigenbaum (1919) can be designated as the originator of the concept of total quality control. In the 851 pages of his textbook *Total Quality Control* (1983), which was originally published in 1951 as *Quality Control*, Feigenbaum develops his approach to TQM, dealing with elements like management of quality, the system for total quality, management strategies and quality, engineering technology and quality, statistical technology and the application of total quality in the enterprise. In the 1950s Feigenbaum worked as quality manager at the General Electric Company and had intensive contacts with companies such as Toshiba and Hitachi. From 1958 to 1968 Feigenbaum became the

world-wide Director of Manufacturing Operations at the General Electric Company.

Feigenbaum contributed two new aspects to the discussion about quality:

- (1) Quality is the responsibility of everybody in the company ranging from top management to the unskilled worker. TQM shall provide the fundamental basis of positive commitment to quality for all employees of the business organisation, from management to assembly workers. It involves everyone. It is a positive effect of TQM that it should build up employee responsibility for product quality. Each individual employee should become interested in product quality. Quality is produced not only by the production department, but also by marketing, research and development, finance, purchasing, and any other department. TQM, so Feigenbaum argued, needs effective ways to integrate the efforts of large numbers of employees with large numbers of machines and technologies. It is the total participation of all employees and the total integration of all the company's technical and human resources that will lead to long-term business success.
- (2) Furthermore, Feigenbaum first recognised that costs of non-quality have to be categorised if they are to be managed. Costs of control and costs of failure of control have to be minimised by a quality improvement programme. The costs of control should be measured, Feigenbaum argues, in two principal areas: prevention costs (e.g. quality training of employees) should keep defective parts from occurring and appraisal costs (e.g. quality audit costs) cover the costs for maintaining the quality level of the company. The costs of failure of control are also measured in two areas: internal failure costs (e.g. scrap) and external failure costs (e.g. customer complaints, reworked material). Feigenbaum notes that, "we have been spending our quality dollars the wrong way: a fortune down the drain because of product failures; another large sum to support a sort-the-bad-from-the-good appraisal screen to try to keep too many bad products from going to the customer; comparatively nothing for the true defect-prevention technology that can do

something about reversing the vicious upward cycle of higher quality costs and less reliable product quality" (Feigenbaum, 1983). The more defective parts, Feigenbaum argued, the higher the failure costs. The traditional reaction to higher failure costs has been more inspection. This traditional post-production inspection syndrome only tries to separate the good parts from the defective ones, but does not make any allowance for prevention of defective parts during the production process itself. The inspection system only controls at a place where the production processes that have possibly generated the defective part have already been completed. More inspection also means higher appraisal costs. The intensified inspection does not have any real effect on eliminating the defects. Appraisal costs will thus remain at a high level as long as failure costs remain high. Feigenbaum suggests, in order to reduce both failure costs and appraisal costs, increasing the expenditure for prevention. Prevention of defects will lead to a reduction of defective parts. This will thus have, Feigenbaum maintains, a substantial reduction in failure costs. Moreover, an increase in prevention costs will result in fewer defective parts and, consequently, will lead to a reduced need for routine post-production inspection and extensive test activities. The final result is a clear reduction of the company's overall costs of non-quality and an improvement of its competitive situation.

Feigenbaum's intention is not so much to create managerial awareness of quality as to assist a business enterprise to design its own quality system which involves every employee. He offers a highly structured approach to total quality which, however, hardly covers the question of motivation and commitment of the individual employee to quality.

The work of Crosby

Philip Bayard Crosby (18 June 1926) has become known for his concept of "Zero defects" and "Do it right the first time" which he expects to be the only standard of

performance. Any other acceptable quality levels (AQL) are not good enough.

Crosby was born in West Virginia. After high school he went to college, graduating as a Doctor of Podiatric Medicine. In 1957 Crosby joined the Martin Company in Florida as a senior quality engineer. In 1961 he started to create the zero defects concept. In 1965 Crosby received an invitation from the ITT Corporation to become its quality director. In 1979 he wrote his best-seller *Quality is Free* published by McGraw-Hill. At that time he founded Philip Crosby Associates, Inc. which is now one of the largest quality consulting firms in the USA. In 1984, he published his second best-seller *Quality without Tears*. Today, Crosby lives in Winter Park, Florida, with his wife Peggy. He is an avid golfer with a handicap of 18.

The starting point of Crosby's concept is his statement that, "Quality is free. It's not a gift, but it is free. What costs money are the unquality things – all the actions that involve not doing jobs right the first time" (Crosby, 1979). To be able to understand quality it is helpful to deal first with a number of erroneous assumptions held by many managers. The first erroneous assumption according to Crosby is that quality means luxury or goodness signifying the relative worth of things. Crosby makes it clear that quality has only to be defined as "conformance to requirements". The customer who talks about quality must define his expectations in specific terms. Then exact measurement can be taken continually to determine conformance of the product or service to those requirements. In case non-conformance is detected, this means absence of quality. A second erroneous assumption, Crosby says, is that quality is not measurable. He points out that it is possible to measure quality quantitatively, as the costs of non-conformance are identical to the costs of quality – the costs of doing things wrong. Another erroneous assumption is that all quality problems originate with the workers of the company. Crosby does not, however, believe that the employees are the prime cause for poor quality. First, he argues, management has to lead by example and the employees follow their example. As Crosby notes, quality inspectors "march blindly past the defects of accounting, engineering, computer programming, and marketing on their way to the manufacturing ghetto to look

for errors". A fourth erroneous assumption according to Crosby is that quality originates in the quality department. He argues that unfortunately many quality professionals feel that they are responsible for quality in their business organisation. These people must learn to call a problem by its real name, namely those who cause the problems, like marketing problems, accounting problems, manufacturing problems, design problems, etc. Crosby points out that quality is the responsibility of every employee in the company. It is not the quality department which is kept responsible for resolving problems over which this department has no control or immediate access to.

This leads to Crosby's idea of the "quality vaccine" which can be used by business enterprises to prevent the problem of non-conformance. He argues that a business organisation can be vaccinated against non-conformance to quality requirements. He recommends applying his four absolutes of quality management.

1. DIRFT – Do it right the first time

Crosby argues that the key to DIRFT is to ensure that clear requirements have been defined and that they are understood by both customers and suppliers. Quality must be defined as "conformance to requirements", and not as goodness. It is then the responsibility of management to establish the internal requirements that the workers are to meet. Furthermore management has to supply the necessary means that the workers need to meet those requirements. Finally, management has to make an effort to encourage and support the workers to meet those requirements.

2. The system of quality is prevention

Since post-production inspection is done after the fact by sorting the good parts from the bad which results in high appraisal costs, the system of quality has to be prevention. Crosby argues that, "Appraisal is an expensive and unreliable way of getting quality. Checking and sorting and evaluating only sift what is done. What has to happen is prevention of errors. The error that does not exist cannot be missed" (Crosby, 1984). The system for causing quality, according to Crosby, is not appraisal but prevention of errors.

3. The performance standard is "zero defects"

A business organisation, as Crosby notes, is like an organism with thousands of small seemingly insignificant actions which make it all happen. Each of these actions should be performed as planned in order to make everything come out correctly. A performance standard established by management is a device for making the company run by supporting the individual employees to recognise the importance of each of these thousands of actions. "Zero defects" is a performance standard. Mistakes are a function of the importance that an employee places on specific things. Employees are more careful about one act than another. Mistakes can be caused by two different type of factors: lack of attention and lack of knowledge. Lack of knowledge can be compensated for by appropriate training and deficiencies corrected. Lack of attention is to be corrected by the employee himself. This is, Crosby argues, an attitude problem. The employee who is prepared to commit himself to monitor carefully each detail and avoid errors, takes an important step toward setting a goal of zero defects in all things while at work. This is his standard of performance.

4. The measurement of quality is the price of non-conformance

Crosby deplores the fact that quality management is hardly taught in business schools. This subject is not considered to be a function of management but rather a technical function only. Often quality is not looked at in financial terms. Crosby divides the costs of quality into two areas: the price of conformance and the price of non-conformance. The price of conformance is understood as the amount which it is necessary to spend in order to make things come out correctly. This includes all prevention efforts and quality training. The price of non-conformance includes all expenses involved in doing things wrong. This refers to, for instance, payments for warranty, correction of work procedures, etc. Quality is measured as the price of non-conformance.

However, Crosby does not make any reference to the actual quality tools and techniques required to realising his concept. He only mentions very briefly statistical methods ("there is nothing wrong with QC and SQC, they are excellent tools in the battle

for quality improvement") and Pareto analysis ("corrective action is more successful when it operates on the well known Pareto principle"). Crosby's approach which offers more help to managers than to engineers, leads to the criticism that he lacks substance. Certainly Crosby is acknowledged as a great orator but beyond that his concept has to be considered to be more motivational than practical.

The work of Ishikawa

Basing his ideas on the works of Juran and Deming, Kaoru Ishikawa (1915) substantially influenced the Japanese understanding of quality. In 1939 he graduated from the Engineering Department of Tokyo University. He obtained his professorship in 1960. He was awarded the grant prize from the American Society for Quality Control for his writings on quality management. Ishikawa died in April 1989.

Ishikawa has become known for his work on, in particular, four aspects of TQM: quality circles, the question of continuous training, the quality tool "Ishikawa diagram", and the quality chain. His approach to TQM comes very close to today's understanding of TQM. As Ishikawa remarks:

Japanese quality control is a thought revolution in management. It is an approach representing a new way of thinking about management . . . To practice quality control is to develop, design, produce and service a quality product which is most economical, most useful, and always satisfactory to the consumer. To meet this goal, everyone in the company must participate in and promote quality control, including top executives, all divisions within the company, and all employees (Ishikawa, 1985).

In this definition, Ishikawa covers a number of key elements of total quality.

TQM emphasises a clear customer orientation – internal and external. The needs of the customer have to be satisfied. TQM is not limited to the quality department but involves all departments within the business organisation. Top management has to lead by example and to demonstrate actively that they are serious about quality. TQM involves everyone within the company; every employee should contribute his ideas of how to improve the work processes.

Ishikawa considers the implementation of quality circles as an effective way of getting

the shop floor involved in the quality issue. In the early 1950s, Ishikawa and the Union of Japanese Scientists and Engineers started to organise training programmes for shopfloor supervisors. They were initially called "Workshop QC Study Groups". In April 1962 these groups were renamed "QC Circle" activities. Since that time, this concept has spread rapidly in Japanese industry. It became one of the important reasons for Japan's business success and has been exported world-wide. The quality circle is a voluntary group of six to eight employees from the same department. They meet regularly in order to discuss aspects of their immediate job environment. It is the aim to improve the work processes these workers are responsible for. Thereby the full expertise, job knowledge and human capabilities of each employee can be fully used. The entire human resources are drawn out. This involvement increases and strengthens the commitment of the individual employee to the quality objectives of the company.

This involvement of all employees in the company's problem-solving process requires a continuous education and training of everyone in the company. Ishikawa claims that TQM "begins with education and ends with education" (Ishikawa, 1989). Because the workforce of a business organisation is constantly changing, Ishikawa argued, and new employees are starting, education and training must be continued. But it is not only the workforce which is changing. Also the needs and expectations of the customers are a moving target and subject to constant change, and Ishikawa stresses the importance that, "QC training and education must also be carried out without interruption, through good times and bad". The Japanese quality expert defines as the aim for a training programme that quality should be made everybody's concern. Every employee should understand the new philosophy of quality. Moreover, everyone should grasp the tools and techniques of TQM.

This takes us directly to one quality tool which was developed by Ishikawa: the "Fishbone" or "Ishikawa" diagram. It is a quality tool which helps to solve quality problems in a systematic manner. It indicates the relationship of the incident or work process being analysed and the various parameters which influence this process.

The widening of understanding which Ishikawa undertakes, is remarkable. He describes the importance not only of meeting the requirements of the external customer, but also of paying attention to "internal" customers and internal relationships. He develops a continuous line of internal supplier-customer relations and invented the term "The next process is your customer". Sectionalism must be broken down. Every employee should be able to talk to other department members freely and frankly. It is necessary to learn to think from the standpoint of the other party. All the different departments within the company are living from the very same external customer. It must be the common goal of each department to fully satisfy this customer. Therefore it would be helpful if the next work process and the next work station which builds on the added value and work of the previous work station, is considered as a customer. The next work process should be treated like the external customer.

We can agree that Ishikawa has contributed and formed a number of important ideas to today's understanding of TQM.

Summing up the work of the five quality "gurus", we can see that the main ideas of their works were primarily oriented to securing the survival of the company by making full use of the company's technical resources. The quality gurus understood that in the increasingly competitive business world after 1945, where many firms were struggling to survive, companies could not afford to

leave any technical resources of the enterprise lying idle. However, the role of the human resource issue and the vital contribution that the individual employee can make to the quality objectives of his company, were hardly recognised by these classical quality gurus. Management needs to make use of all resources – technical and human. Without the total commitment of all employees, the work organisation will have great difficulties in surviving in today's business world. This important dimension of total quality was ignored by the above writers. To cover this aspect of TQM in more depth, please see Krüger (1998).

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Commentary

A valuable overview of the work of some of the key thinkers in the quality movement.