TOTAL QUALITY MANAGEMENT

The Origins of TQM
TQM was first introduced by Feigenbaum in 1957, but more recently various quality Gurus have enhanced and developed the notion. It is important to understand the contributions made by these quality gurus to help understand the origins.

Armand FEIGENBAUM - was a doctor in the Massachusetts Institute of technology in the 1950's and he defined TQM as: 'An effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organisation so as to enable production and service at the most economical levels which allow for full customer satisfaction'.

W.E.DEMING - asserted that quality starts with top management and is a strategic activity. Deming's philosophy is that quality and productivity increase as process variability decreases (a decrease in the unpredictable). In his 14 Points for quality improvement he emphasised the need for statistical control methods, education, openness, purposeful improvement and participation:

Create constancy of purpose

Adopt new philosophy

Cease dependence on inspection

End awarding business on price

Improve constantly the system of production and service

Institute training on the job

Institute leadership

Drive out fear

Break down barriers between departments

Eliminate slogans and exhortations

Eliminate quotas or work standards

Give people pride in their job

Institute education and self-improvement programme

Put everyone to work to accomplish it.

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3. **J.M.JURAN -** tried to get organisations to move away from the traditional manufacturing-based view of quality 'as conformance to specification' to a more used-based approach, for which he created the phrase 'Fitness for Use'. He pointed out that a dangerous product could conform to specification but would not be fit for use. Juran was concerned with management activities and the responsibility for quality, but was also concerned about the impact of individual workers and involved himself to some extent with the motivation and involvement of the work force in quality improvement activities.

4**. K. ISHIKAWA** - created what is known as quality circles and cause-and-effect diagrams. Ishikawa claimed that there had been a period of over-emphasis on statistical quality control that caused people to dislike it. People became fed up with complexity, using complex tools to solve the problems. Furthermore, the resulting standardisation of products and processes and the creation of rigid specification of standards became a burden that not only made change difficult but made people feel bound by regulations. Ishikawa saw the worker participation as the key to the successful implementation of TQM. Quality circles were an important vehicle to achieve this.

G. TAGUCHI - was concerned with engineering in quality through the optimisation of product design combined with statistical methods of quality control. He encouraged interactive team meetings between workers and managers to criticise and develop product design. His definition of quality uses the concept of the loss that is imparted by the product or service to society from the time it is created. He created Quality Loss Function (QLF) that included factors such as costs of warranty, customer complaints, and loss of customer goodwill.

P.B. CROSBY - Suggested that many organisations do not know how much they spend on quality, either in putting it right or getting it wrong. He claimed that organisations that have measured their costs say they equate them to about 30% of sales. Crosby tried to highlight the costs and benefits of implementing quality programmes by providing the 'zero defects' programme, aimed at reducing the total cost of quality. This is summarised below:

Quality is conformance to requirements

Prevention not appraisal

The performance standard must be 'zero defects'

Measure the price of non-conformance (PONC)

There is no such thing as a quality problem

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His 14 steps of quality are as follows*:*

Establish management commitment

Form interdepartmental quality terms

Establish quality measurement

Evaluate quality measurement

Evaluate cost of quality

Instigate corrective action

Ad Hoc committee for the zero defects programme

Supervise employee training

Hold a zero defects day

Employee goal setting

Error cause removal

Recognition for meeting and exceeding goals

Establish quality councils

Do it over again

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As one can see from the inputs from the quality gurus, each of them contributed to the structure of TQM. The inputs have strengths and weaknesses, which can be seen in table 1.

Table 1 **The Strengths and Weaknesses of the Quality Gurus**

Quality Guru	*Strengths of Approach*	*Weaknesses of Approach*
Feigenbaum	Provides a total approach to quality control Places the emphasis on the importance of management Includes socio-technical thinking. Participation by all staff is promoted	Does not discriminate between different kinds of quality context. Does not bring together the different management theories into one coherent whole.
Deming	Provides a systematic and functional logic, which identifies stages in quality improvement. Stresses that management comes before technology Leadership and motivation are recognised as important. Emphasises role of statistical and quantitative methods Recognises the different contexts of Japan and North America	Action plan and methodological principles are sometimes vague The approach to leadership and motivation is seen by some as diagnostic Does not treat situations which are practical or coercive
Juran	Emphasises the need to move away from quality hype and slogans Stresses the role of the customer both internal and external Management involvement and commitment are stressed	Does not relate to other work on leadership and motivation Seen by some as undervaluing the contribution of the worker by rejecting bottom-up initiatives Seen as being stronger on control systems than the human dimension in organisations

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Ishikawa	Strong emphasis on the importance of people and participation in the problem solving process A blend of statistical and people-orientated techniques Introduces the idea of quality control circles	Some of his problem solving method seen as too simplistic Does not deal adequately with moving quality circles from ideas to action
Taguchi	Approach pulls quality back to the design stage Recognises quality as a societal issues as well as organisational one Methods are developed for practising engineers rather than theoretical statisticians Strong on process control	Difficult to apply where performance is difficult to measure (Service sector mainly) Quality is seen as primarily controlled by specialists rather than managers and workers Regarded as generally weak on motivation and people management issues
Crosby	Provides clear methods which are easy to follow Worker participation is recognised as important Strong on explaining the realities of quality and motivating people to start the quality process	Seen as implying that workers are to blame for quality problems Seen by some as emphasising slogans and platitudes rather than recognising genuine difficulties. Zero defects sometimes seen as risk avoidance Insufficient stress given to statistical methods

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WHAT IS TOTAL QUALITY MANAGEMENT (TQM)- The Quality in TQM

TQM is a philosophy, concerned with meeting the needs and expectations of customers. It attempts to move away from the focus of quality been strictly operations and tries to re-focus upon the whole organisation as a unit of quality. 'A TOTALITY OF INVOLVEMENT', everybody's responsibility, everyone focused on reducing the cost of quality, and continuously improving to achieve this across the organisation.

TQM is an extension of quality control

TQM can be viewed as a logical extension of quality control. Quality was achieved by inspection initially - screening out defects before the customer noticed them. Quality control created the systematic approach to not only detecting, but also treating the quality problems. Quality assurance widened the responsibility to include functions other than direct operations. TQM obtained most of this but developed its own themes, which were distinctive. TQM is concerned with the following:

Meeting the needs and expectations of customers

Covering all parts of the organisation

Including every person in the organisation

Examining all costs which are related to quality

Getting things 'right first time', i.e. Designing in quality rather than inspecting it in

Developing the systems and procedures which support quality and improvement

Developing a continuous process of improvement

This development of quality can be seen as an extending cube, expanding the boundaries, forcing the more outward approach, rather than the original inward looking inspection approach. The cube is figure 1 seen on page 8.

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The Natural Expansion to Quality Management

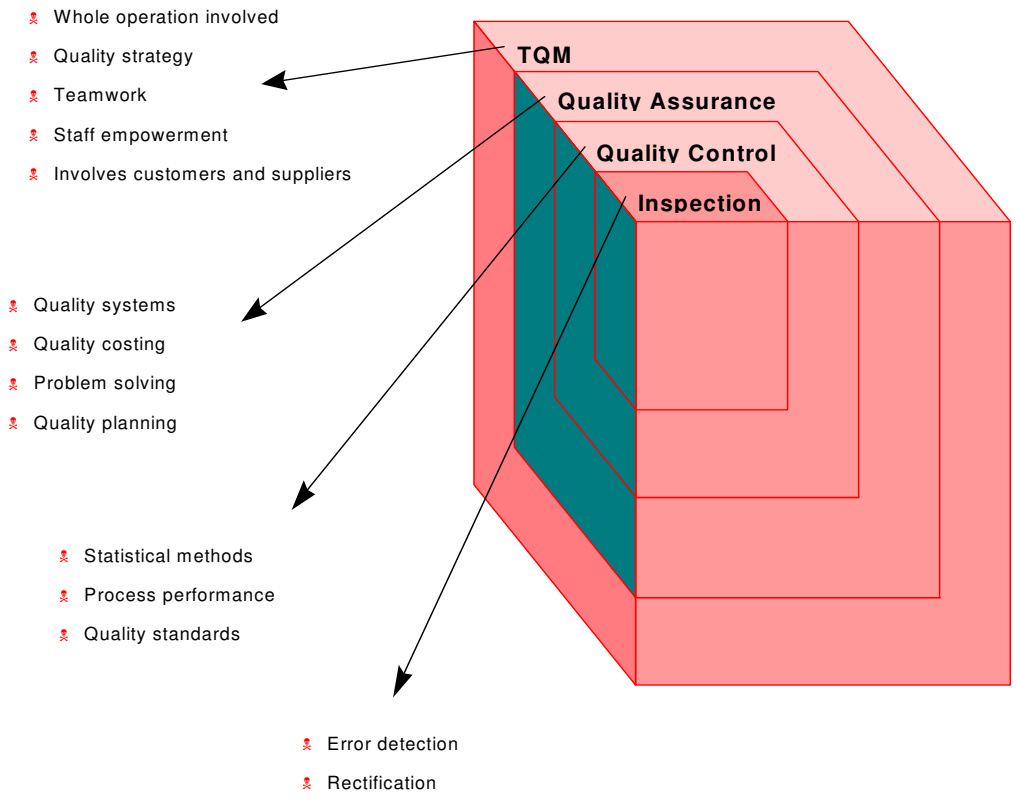

Figure 1

TQM meets the demand and expectations of the customers

There is little point of putting a quality system in place unless it meets the demand of the customers. Defining the customer demand is a key marketing job. Marketing must also understand the ability of its own operation so it does not promise things to the client that it cannot live up to. However, in TQM the approach means more, it means seeing things from a customer point of view. This involves the whole organisation in understanding the central importance of customers to its success and even its very survival. Customers are seen not as being external to the organisation but part of it. Customers are also human beings and must be treated as such; they are not statistics as a lot of companies still actually consider them. Attentive and courteous treatment all of the time.

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Other companies state TQM in terms of how they are going to serve their customers:

Marks and Spencer - "continual improvement of customer service is essential, four out of five members of store staff are now employed on the sales floor and specialist sales assistants are being trained to give knowledgeable help and advice to customers".

BMW - "Customer requests made at short notice can be met more satisfactorily. BMW dealers again made substantial investments to improve conditions for long-term sales opportunities and intensive customer service".

EuroDisney - "our second and ongoing challenge is to continue a very intense training programme to ensure that our service never ceases to improve".

Carnaud Metalbox - "customer partnership is the other key to our future … most of our business can be traced to improved customer service".

TQM puts the customer at the front when making decisions and should be reflected at all stages of corporate decision-making, distraction can be fatal. Not all companies succeed. One brewery used to deliver beer to public houses and bars according to delivery schedule that suited the brewery. The schedule was designed to minimise travelling distance and maximise the number of deliveries made. One customer was based in London and the brewery set up the schedule for Fridays (busiest time). When the customer asked for a change of delivery the brewery said it was not within their schedule. The customer was not a happy and satisfied customer and withdrew from further sales.

TQM covers all parts of the organisation

"For an organisation to be truly effective, every single part of it, each department, each activity, and every person and each level, must work together, because every person and every activity affects and in turn is affected by others".

The most powerful aspect to emerge from TQM is the concept of the internal customer and supplier.

This means everyone is a customer within the organisation and consumes goods and supplies goods to others. By reducing the boundaries between internal and external, everyone becomes responsible to the needs of the external customer. Removing the errors at the internal stages helps by producing the goods at the satisfaction of the external customer. Each micro operation is responsible for internal customer/supplier relationships within the macro operation. The external customer definitions provide the performance objectives required to meet this demand for the internal customers. This constitutes toward error-free service - the quality, speed, flexibility, dependability or cost. These performance objectives replicate from micro operation to micro operation. This can be seen in figure 2. Figure 3 shows the performance objectives and how they are the link between the internal and external customer.

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The Internal Customer/Supplier Relationship Between Micro Operations

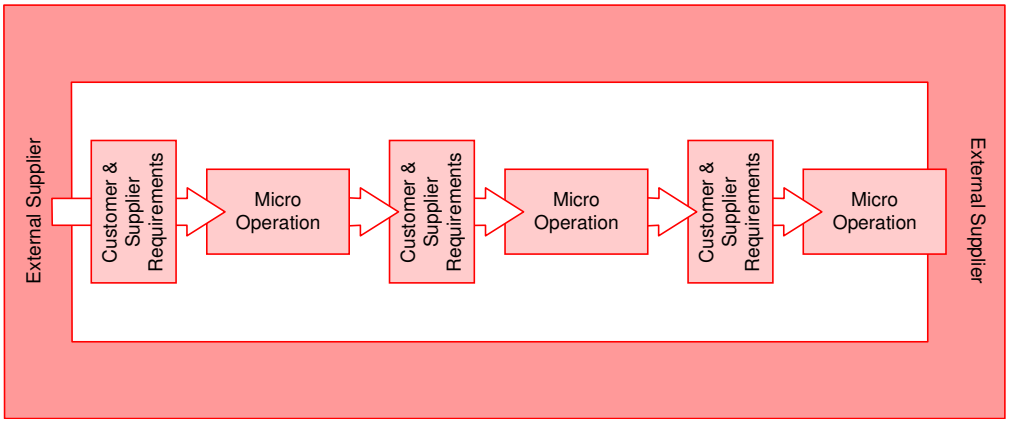

Figure 2

Manufacturing Performance Objectives

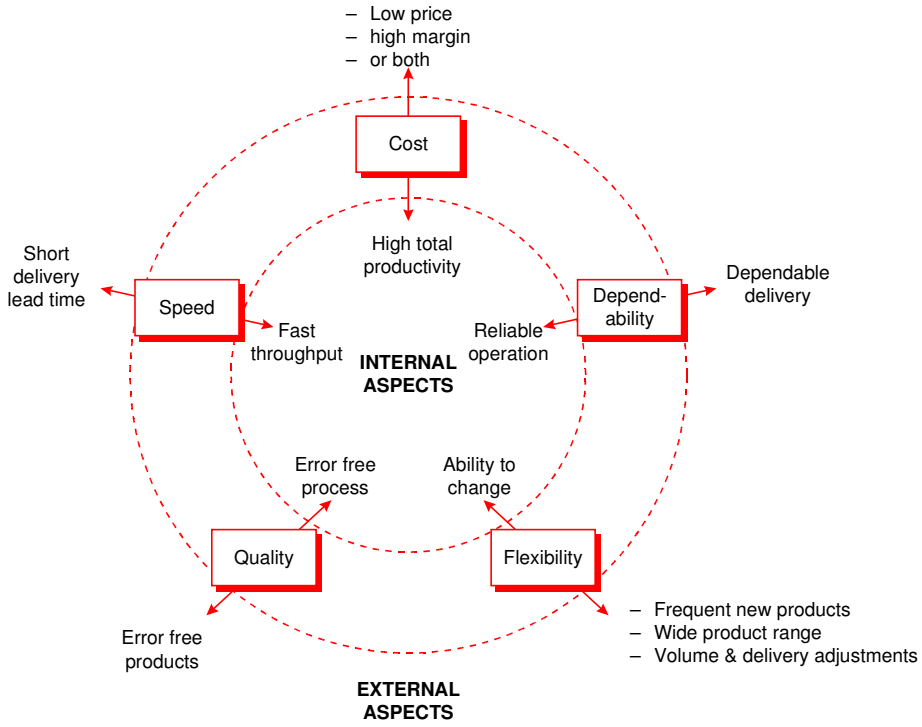

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Figure 3

As well as helping to embed the quality imperative in every part of the operation, the internal - customer concept is useful because it impacts on the upstream parts of the internal supply network. These parts of the organisation, especially those who provide internal services, can be the origin of errors, which do not always become evident until later in the process. This backtracking effect, especially in manufacturing becomes very expensive it is not trapped before it reaches testing and verification. The further down the line the error is spotted, the bigger the cost of quality.

Processes like concurrent engineering are put in place to help trap these errors in the design phases. Catch it in product when it is cheap before it breaks you in process, as the saying goes. The diagram in figure 2 is very simple but very self-explanatory. In reality the functions are extremely more complex and highly cross-referenced with each other, the best way to keep on track is to keep going back to the original simple concept and what it is trying to achieve.

A very useful set of checklists, which I find quite useful, were developed by Hewlett Packard for the computer industry. They are the checklists for internal customers:

The checklists should ask themselves seven questions, which it regards as fundamental to the operation:

Who are my customers?

What do they need?

What is my product or service?

What are my customer's expectations and measures?

Does my product or service meet their expectations?

What is the process for providing my product or service?

What action is required to improve the process?

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From these questions Hewlett Packard went on to devise the problem-solving methodology:

Select the quality issue

Write an issue statement

Identify the process

Draw a flow chart

Select a process performance measure

Conduct a cause-and-effect analysis

Collect and analyse the data

Identify the major causes of the quality issue

Plan for improvements

Take the corrective action

Collect and analyse the data again

Are the objectives met?

If yes, document and standardise the changes

Service Level Agreements

Some organisations bring a degree of formality to the internal customer concepts by encouraging (or actually requiring) different parts of the operation to degree service-level agreements (SLAs) with other. SLAs are formal definitions of the definitions of the dimensions of service and the relationship between two parts of an organisation. The type of issues which would be covered by such an agreement could include response times, range of services, dependability of service supply and so on. (All of these are performance objectives - that is, speed, flexibility and dependability). Boundaries of responsibility and appropriate performance measures could also be agreed.

An example, an SLA between an information systems support unit and a research unit in the laboratories of a large company could define such performance measures as:

The types of information network services which may be provided as 'standard'

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The range of special information services which may be available at different periods of the day.

The minimum 'up-time', i.e. the proportion of time the system will be available at different periods of the day.

The maximum response time and average response time to get the system fully operational should it fail

The maximum response time to provide 'special services', and so on

THE 'TOTAL' IN TOTAL QUALITY MANAGEMENT

The main difference between the traditional approach to quality and TQM is the word 'TOTAL'. A totality of involvement is what has transformed quality management from a monitoring performance to being the centre of the drive within an operation.

Total means all everyone in the organisation

Just as the quality performance of the whole company is made up of the quality performances of each part of the company, each department's quality efforts are the sum total of the individuals in it. Just as each department is viewed as a process with suppliers and customers, so can individuals be viewed on their performances, making sure the alignment of the individual is the same as that of the organisation as a whole?

All in all this depends on the management and the environment the individual is working. A non-contributory environment leads to nothing other than failure, as does a management system that is not interested in the outcome. Management is a general catalyst for contributory environments, it creates openness, honesty and more so an interest in the general happenings of the company. Encouragement by managers creates an influent atmosphere in which people can learn from their mistakes, forever improving their performances in the field**.**

Total means all costs of quality are considered

There is a cost considered with any company quality effort, but these costs are tiny compared to the costs of not having good quality.

Traditional approaches to quality related costs were concerned mainly with trying to find the optimum amount of effort to be put into improving quality. The argument being that there must be a point beyond which diminishing returns set in - the cost of improving quality gets larger than the benefits which it brings. This is best seen in figure 5.

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Traditional Cost of Quality Model

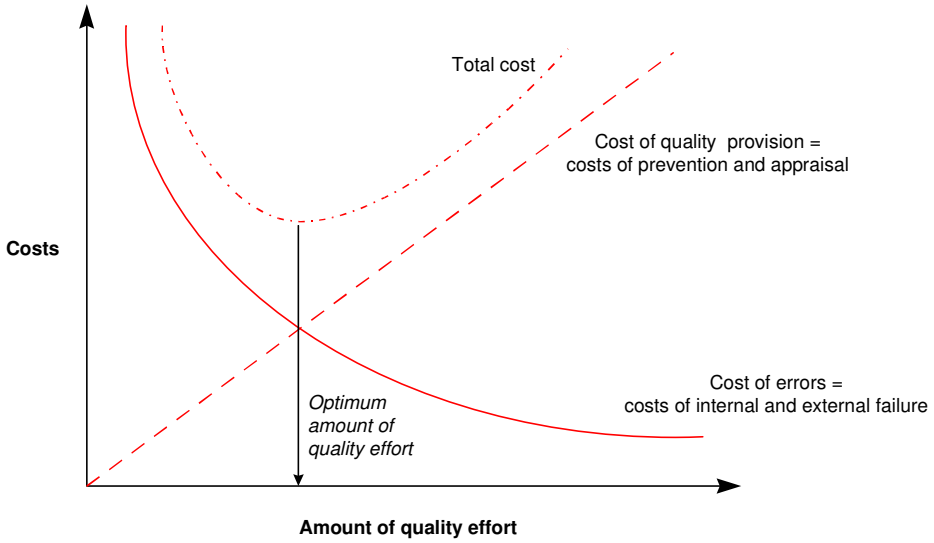

Figure 5

The diagram is very misleading and supposedly shows that as quality effort is increased, the costs of providing the effort - through extra quality controllers, inspections and so on - increases proportionally. But at the same time the cost of errors, faulty products, and so on, decreases because there are fewer of them. All the extra inspectors prevent them getting out.

In reality this is totally flawed in two important ways. It underestimates one set of costs and overestimates the other. Take the cost of providing quality. The assumption is that more quality means more inspectors and so more cost. Doubling the effort put into quality means, if not doubling the resources, it certainly means doubling the cost. This is of course not true. TQM is set to make sure individuals do it right first time, or at least aim for achieving this. This may incur costs in training and general mind alignment but definitely not as steep as inclined in the figure 5.

The costs of errors curve suffer the exact opposite, a massive underestimate of the true cost. The cost is commonly taken to include reworking defective parts, or cost of scrap and material loss, or the loss of goodwill or even warranty costs if the defective part gets out to the customer. Here, the biggest cost is left out, totally forgotten about and can be the most damaging to the company, 'the cost of disruption' which errors cause. The cost of disruptions can be mind-blowing, ranging from wasted management time in organising rework and rectification, losses of concentration, which slows the workforce down and most of all an erosion of confidence. Quality is an infinite amount, it is something man aims to obtain as a unit in his hand but can effectively never achieve. All he can do is

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continuously improve and become as near to the infinity as possible. The nearer you are, the lower the reduction of errors, never will it be perfect, but as near as damn it will do.

If you put these two corrections into the optimum quality effort calculation the picture looks totally different, as in **figure 6** below:

Actual Quality Model

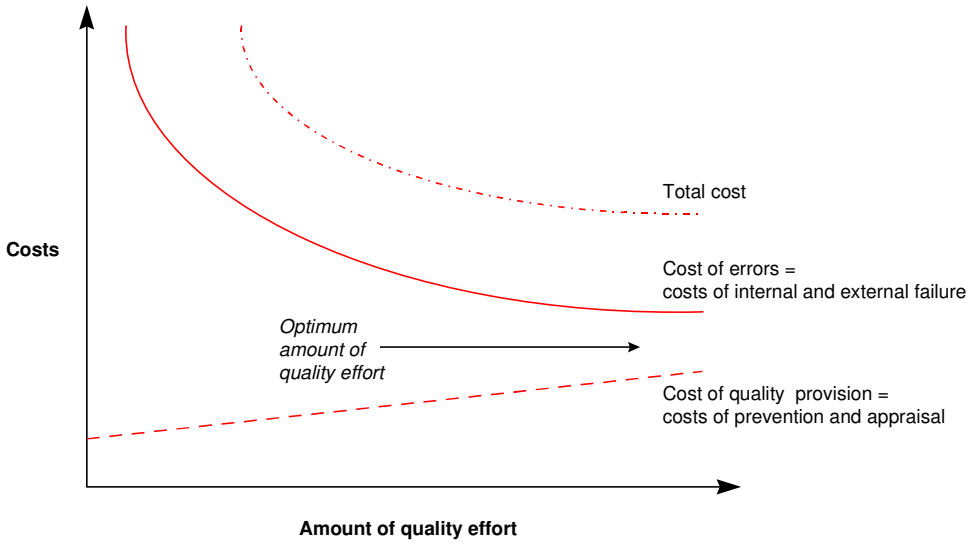

Figure 6

If there were an optimum, which in reality is perfection (hence cannot exist), it would be a lot more to the right in the direction of putting in more effort and not necessarily more cost.

Rather than searching for the optimum, which companies are still doing in the manufacturing industry, very few have changed; it is better to search for the roots of costs related to quality. These can be seen in four layers, which are highlighted in the diagram below, figure 7.

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Increasing the Effort into Preventing Errors Occurring in the First Place

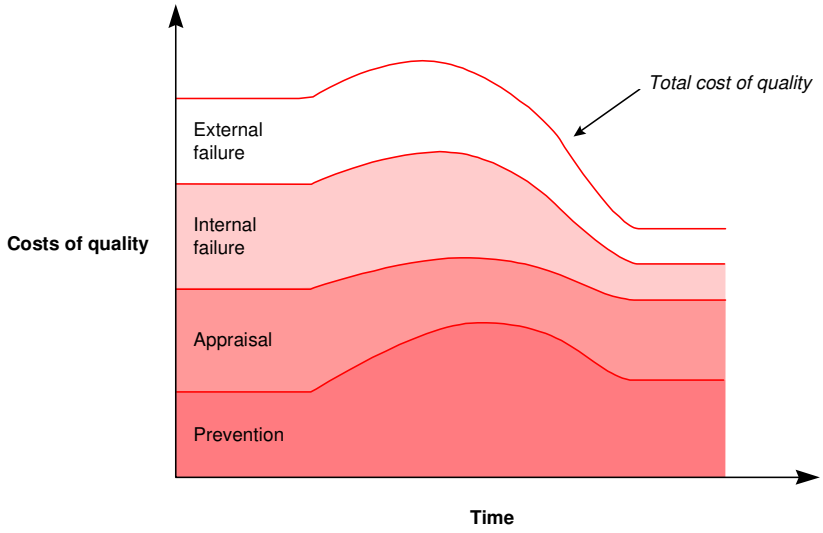

Figure 7

Costs of quality come under four headings:

Cost of Prevention - stopping errors occurring in the first place.

Engineering the product so that it cannot be put together incorrectly (Design for manufacturing and Design for testing)

Checking product specifications and drawings

Preventative maintenance of process equipment (FMEA and SMED)

Developing and operating quality measurement equipment (improved management technology)

Administering quality procedures (ISO 9000, BS5750)

Surveying quality levels, problem solving and implementing quality improvement projects (QFD, Kaizen, Poke Yoke)

Supplier appraisals and training

Training and development of personnel

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Costs of Appraisal - checking to see if errors have occurred after the event.

Product prototype testing

Inspection and test of incoming goods

Inspection and test of internal processes

Field checks of product performance

Processing inspection and test data

Costs of Internal Failure - coping with errors while they are still inside the organisation.

Scrapped parts and materials

Reworked parts and materials

Diagnostics of quality defects and failures

Lost production while process is stopped

Reorganising processes and procedures after failure

Product redesign and engineering change orders and finally, but possibly the most significant.

The lack of managerial concentration and focus caused by troubleshooting rather than improving the plant

Cost of External Failure - the cost to the company of the product failing after hand-over to the customer.

Warranty costs

Servicing costs

Product Liability

Complaints administration and most important in the long run, but difficult to assess

Loss of customer goodwill affecting future business

The useful outcome of looking at quality-related costs is that it helps companies to assess relationship between the various cost categories. Of the four areas, two are open to

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managerial influence (costs of prevention & costs of appraisal), while the other two are the consequences of changes in the others (costs of failure & costs of external failure).

Preventing errors in the first place is the better and more long-term successful focus for management.

What seems to happen is that increased and effective effort put into defect prevention has an almost immediate positive effect on internal failure costs, followed by significant reductions in external failure costs and, once confidence has been firmly established, in appraisal costs. Eventually even production costs can be stepped down in absolute terms, though prevention remains a significant cost in relative terms. Figure 7 shows this idea. Initially total quality costs may rise as investment in some aspects of prevention are increased, like training. Some reduction in total costs quickly follows, usually in months (weeks) rather than years.

Putting realistic figures to the quality cost categories of prevention, appraisal and failure in not such an easy task in reality. Some of the following areas were exposed at Thorn EMI Electronics:

Difficulty was highlighted when trying to separate quality-related costs form those, which were an integral part of the manufacturing operation.

Cost categorisation into prevention, appraisal and failure proved more meaningful to quality managers than operations managers.

Costs of activities which were part-time activities of indirect staff proved very hard to derive

Accounting systems were not designed to yield quality-related costs and different accounting practices distorted the results to save themselves from exposure.

The significance of warranty costs proved difficult to gauge because they were related to earlier manufacture. Forecasting loss was not a major practice at Thorn EMI.

Total means all stages in quality improvement are important

Total quality management means permanently solving quality problems, and laying the foundations for further improvement in quality performance. To do this the quality improvement process must extend beyond its traditional monitoring and detection role. The implications of this are for the professionals and quality facilitators in the organisation - the traditional quality department. It means they need to involve themselves in the total process of defect elimination. Not only monitoring the process and recording its performance, but also analysing its performance over time, proposing solutions to any quality problems thus revealed, developing ideas for improvement, implementing the resulting changes to the process, and again monitoring the effects of the change on performance. They need to address the whole problem solving cycle, as seen in figure 8.

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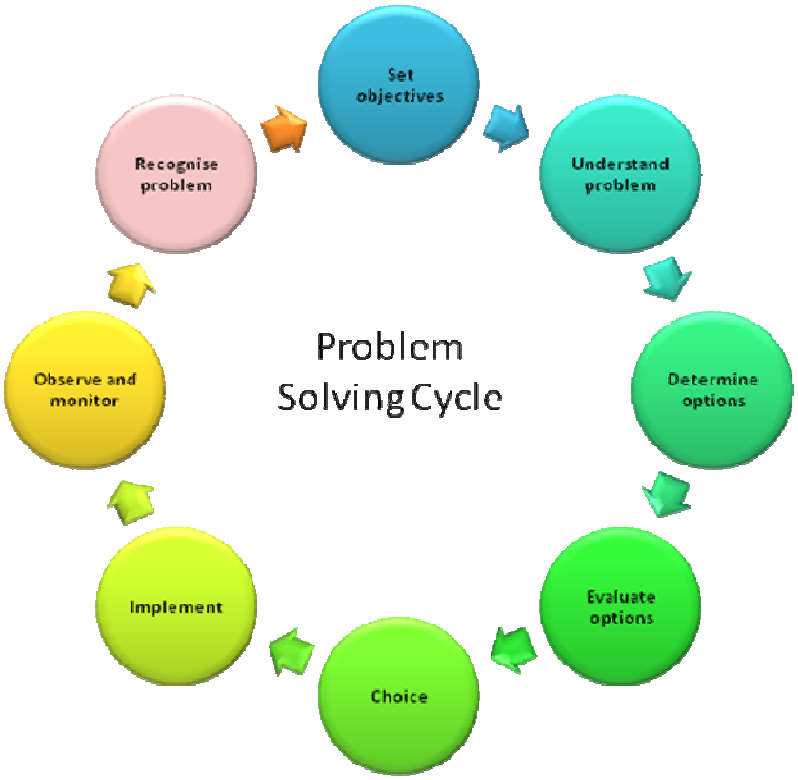

Figure 8 Total means all improvement is seen as continuous process

The bottom level is you never solve the quality problem you just lay the foundations for continuous improvement. Continuous improvement is not just a short sprint it is a marathon. Success depends on maintaining an even pace rather than producing short-lived and exhausting bursts of speed. Like the Tortoise and the hare, the tortoise beats the hare in the end, as the hare does not maintain a steady pace.

This means a change of attitude to improvement is required; success should be simply making an improvement. Keeping the momentum going is what makes it work.

A typical example is of a UK Truck Corporation called Eaton whose plant in Basingstoke was a typical high volume, high variety one. Ford motors were putting them under pressure about the level of quality they were providing. The pressure form its customers and the threat form competitors getting in caused them to go through a major rethink and sort out their problems.

Using statistical process control as the major driver of its quality programme, the company achieved considerable improvements. One of its flow lines, which operated 24 hours per day, was producing very high levels of scrap (internal failure costs) and causing customer complaints over delivery and quality (external failure costs). The company's response was to set up an extensive 3-day improvement programme, which shut down the line over this

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period (prevention costs). It also decided to use the three days to train the workforce (further prevention costs). The 3 days help create a proposed layout which reduced standard time by 10%, reduction of set-up time by 6 hours and created right first time ideas to reduce rejects.

Overall internal failure costs were reduced, showing the cost of quality reduced from 10.87% to 4.7% over 4 years of continuous improvement. Profitability definitely improved.

THE 'MANAGEMENT' IN TQM - Implementing TQM
TQM places the quality function in possibly a difficult, certainly a challenging and more influential position. Its role must change; quality professionals should no longer be in sole control of quality and all of the tasks related to it. Roles must be wider, ranging across all of quality planning and implementation tasks, and it should be more consulting, facilitating, guiding, co-ordinating and monitoring.

What makes successful Quality Improvement programmes?
Of 500 US manufacturing and service companies, only a third felt their TQM programmes had significant impact on their competitiveness.

Only one 20% out of 100 British firms believed their quality programmes had achieved results.

Of those quality programmes that have been in place for more than 2 years, 66% simply ground to a halt because of their failure to produce hoped for results.

These are the realities, the question is WHY?

There are two broad answers to this question:

The TQM initiative is not introduced and implemented effectively

After the TQM has been introduced successfully its effectiveness fades over time.

A number of factors appear to influence the eventual success of performance improvement programmes such as TQM. These are as follows:

A Quality Strategy
Without thinking through the purpose of TQM and its long term values, not just what it is going to achieve in the next week, companies have a tendency to race into implementation without a direction, without a strategy.

A quality strategy is necessary to provide the goals and guidelines that help to keep the TQM programme heading in a direction, which is appropriate for the organisation's other strategic aims. The strategy would have the following:

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The competitive priorities of the organisation, and how the TQM programme is expected to contribute to achieving increased competitiveness.

The roles and responsibilities of the various parts of the organisation in the quality improvement.

The resources, which will be available for quality improvement.

The general approach to, and philosophy of, quality improvement in the organisation

Top management support

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