CHAPTER – 3
PRODUCTIVITY- QUALITY: CORRELATION

3.1 Historical perspective and concept of quality

Quality has a longer history in our lives than both cost and productivity, and is the only one of the three that is a common concern of both companies and customers. It is for reasons such as these that quality is regarded as a more ‘human’ concept than either cost or productivity.

Quality Introspect\(^{38}\) : After the World War II, two major forces emerged that have had a profound impact on Quality.

1. The first force was the Japanese revolution in Quality.
2. The second major force was the prominence of product quality in public mind.

Several trends came together to high-light this prominence: product liability cases, concern about the environment, some major disasters and near disasters, pressure by customer organisation and the awareness of the role of quality in trade weapons and other areas of international competition resulted in self orientation of organisations.

These two major forces, combined with other, have resulted in a changing set of business conditions that are entangled with the quality parameter. The quality becomes a prime priority and therefore there is hard need for all concerned to discuss the pertinent issues of quality in common platform and explore new possibilities, ways for utmost customer satisfaction. The common platform is aimed at providing an appropriate forum for Engineers, Scientists, Academicians, Researchers, Executives, Managers to come together and discuss the “state of art” in the selected topics within broad field of Quality Introspect for their mutual benefits. The objective is professional advancement leading to organisational performance improvement technologies in the context of Quality Improvement and Cost Reduction, and Productivity, and Performance improvement, etc.

Quality Gurus: Quality contributors\(^{39}\): The modern quality management approach is reflected in the following discussion of quality gurus, the ideas that quality drives the productivity machine, other aspects of quality picture, and emerging quality

\(^{38}\) Sharma, Sunil, Total Engineering Quality Management, Macmillan, (2003), vii-xii.
standards. The modern era of quality is a few new thinkers’ heralded management. Among these Deming, Crosby, Feigenbaum, Ishikawa, Juran and Taguchi are noteworthy. These educators, authors and consultants worked with industry to start companies on their way to the development of quality improvement programs.

**Edwards Deming**, a professor at New York University travelled to Japan after World War II at the request of the Japanese government to assist its industries in improving productivity and Quality. Edwards Deming is known as the ‘father of Quality Control’ in Japan, but his recognition in his own country the United States was a long time coming. He taught Japanese that higher quality meant lower cost. He told U.S. managers that they must create consistency and continuity of purpose, refuse to allow mistakes; defective materials; defective workmanship, eliminate the need for mass inspection, reduce the number of suppliers, buy on statistical evidence, search continually - the ways to improve it, institute modern methods of training-using statistics, focus supervision on helping people to do a better job. Use statistical methods for continuing improvement of quality and productivity and eliminate all standards presenting numerical quotes.

**Phillip Crosby** wrote ‘Quality is free’ in 1979 a set of traditional thinking about acceptable levels of defects on its era. Crosby contended that any level of defects is too high and companies should put programs into place that will move them continuously toward the goal of zero defects. The main idea behind free quality is that the traditional trade-off between the costs of improving quality and the costs of poor quality is erroneous. The costs of poor quality should include all the costs of not doing the job right the first time. Scrap, rework, lost labour hours and machine hours, the hidden costs of customer, ill will and lost sales, and warranty cost. He states that the cost of poor quality is so understated that unlimited amount can be profitably spent on improving quality.

**Dr. Armand Feigenbaum**, the originator of the TQC concept, advocates a total approach to quality, involving everybody in any process and manufacturing or not. He argues the benefits of *preventive maintenance* as opposed to *fire fighting*, and of the efforts for an early-stage *build-in of quality* as opposed to *relying on inspection*. To him, quality is simply a way of managing a business organisation, and needs a customer-oriented, cost-effective quality management programme. He developed the concept of ‘*Total Quality Control*’ (TQC) in his 1983 book. He contended that the
responsibility for quality must rest with that person who does the work. In TQC, where product quality is more important than production rates, workers are given the authority to stop production whenever, quality problem occur.

**Professor Ishikawa**, (1962), pioneered ‘QC circle’ in Japan. *Small Group Activities* - The most widely used name is ‘QC circles’. The members meet occasionally on a voluntary basis, with the main purpose of problem solving. Comprising these groups are people from management and the workforce, as well as from suppliers and subcontractors. These people work together on an equal basis; this strengthens team spirit, the hidden potential of the workforce can be utilised for the benefit of the company (as well as the individual) through a *suggestion system*. This is an integral part of individual-oriented *Kaizen* and can be the source of numerous opportunities for improvement on a continuous basis. He is the pioneer of certain quality tools such as the cause and effect diagram and movements such as quality circles in Japanese organisation. Ishikawa strongly believed in the provision of a proper quality control education, initially to factory foreman / workmen and supervisors, and subsequently to grass-roots workers.

**Joseph Juran** argues, in his quality control handbook, for top management commitment to improve product quality, quality planning, statistics to identify discrepancies, and continuous improvement of every aspect of product quality. U.S. companies discovered Juran, like Deming, Juran played an important and early role in teaching Japanese manufacturers how to improve their product quality.

**Genichi Taguchi** has consulted with leading companies such as Ford and IBM to assist them in developing improved *statistical control* of their processes. Taguchi contends that constant adjustment of production machines to achieve consistent product quality is not effective and that, instead products should be designed so that they are *robust enough* to function satisfactorily despite variations on the production line or in the field.

**Taiichi Ohno**, the pioneer of the *Kanban* system in Toyota’s plant, has identified many categories of waste which are avoidable: overproduction, waste in motion and transportation of units, waste in processing and machine time, waste in taking inventory and waste resulting from defects. Eliminating wasteful interruptions and reducing the lot sizes will allow for better responsiveness to the customer’s exact timing requirements. Ohno combined the *Kanban* system with another structural
feature called *jidohka* (or automation); where by an automatic mechanism stops the entire production system whenever a defective part is found along the process line. Appropriate adjustments then take place so that major problems are prevented from arising in the future.

**Shigeo Shingo** (1960), a Japanese quality specialist pioneered the ideas of auto-rotation. In the early 1960s Shingo developed the concept of *poka-yoke* (or defect = 0), meaning mistake proofing: source inspection is employed actively to identify process errors before they become defects; when an identification takes place, the process is stopped until the cause is determined and eliminated.

*The thinking of these quality gurus has individually and collectively; permanently influences the management of products and service quality.*

### 3.2 Quality - Productivity interdependency

The quality of a product and its productivity are completely interdependent. To achieve quality one can’t sacrifice productivity and vice-versa. The quality and productivity mainly depends on the kind of personnel recruited in the industry. If a person receives training in different interrelated disciplines of an organisation, he will be more in demand than a person receiving specialisation in a particular aspect of it.

Future stakeholders must be trained in different aspects viz. industrial design and its analysis, management of quality and productivity, utilisation of computers for quality design and its maintenance, and knowledge of quality standards and its maintenance.

The concept of ‘*globalisation*’ has progressed from a buzzword in the nineties to a reality in the 21st century. Some of the major propelling forces include the globalisation of capital markets, the declining costs of transportation, communication and information technology and the growth regionally and internationally.

Productivity is the parameter to measure the performance of the production factors. If the productivity is measured only in terms of a simple production factor such as labour or capital then it is known as ‘*practical productivity*’, otherwise ‘*total productivity*’ if it is for all the production factors.

- **At the micro level:** a relationship between the output of organisation and its required input.

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• **At the macro level:** measures the relationship between aggregate commitment and self-discipline of the employees is essential.

Productivity can be used as yardstick for comparison of our activities with that of competitors’ or market leaders’. It is the most acceptable qualitative parameter for any firm to emerge as global player. In India more emphasis should be given on R&D and IT to accelerate the productivity at the micro as well as macro levels.

As India is leading for globalisation, Indian organisations have to evaluate themselves in terms of internal as well as external productivity norms and prepare for adapting latest developments to make their presence felt in the global market. The economy is shifting towards services therefore contribution of service sector is much higher as compared to the manufacturing sector.

Productivity is one of the major criteria, which distinguish a developed economy from the developing or under developed economy. Earlier, nobody bothered what competitors were doing in the industry because products were selling in the market without any additional efforts.

The author suggests two important aspects that should be considered while assessing productivity:

• It has to be an unending process with the total involvement or commitment of the top management.

• Human element is the pulley around which productivity revolves. Human resource workforce has to be treated as the vital resource. Workers have to be motivated, delegated, empowered and made accountable.

Productivity is not confined to only quantity of the product but in other terms too, such as quality and services to the customers. At present in globalisation era to compete qualitatively and quantitatively organisations should adopt change.

### 3.3 Quality drives the productivity machine

The traditional view of quality control was that it costs more to get higher product quality. But it is no longer the prevalent view. Japanese manufacturers are credited with popularising the notion that quality drives the productivity machine. This means that if production does it right the first time and produces products and services that

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are defect-free, waste is eliminated and costs are reduced. In this new way of thinking, when operations managers work to eliminate defects, the quality of products and services is improved and at the same time productivity also improves. *Costs are reduced as product quality improves because there are fewer products lost to scrap, fewer products returned for warranty work, and fewer interruptions to production.*

It has been estimated that 20 to 25 percent of the overall cost of goods sold in the United State is spent on finding and correcting errors. “Quality Management Programs” today are therefore, viewed by many companies as “Productivity Improvement Programs.”

The Productivity pathway to satisfy workers’ needs is shown in figure 3.1.

![Figure 3.1: The productivity pathway to satisfy workers’ needs](image)

If employees see productivity as a means of satisfying their needs, high productivity is likely to result. Once employees have their needs satisfied through rewards that have been conditional upon productivity, the process is likely to be repeated (See Figure 3.1 illustrates this concept).

### 3.4 The management of engineering quality – Philosophical approaches

**Total Engineering Quality Management:** With ongoing liberalisation of Indian economic, the competitive pressure on the industry has increased substantially. The key to economic success is the consistent quality of product and services at *right place* and *right time*. The products and services must be made to rise above customer expectations, delighting them rather than merely satisfying them. The total quality approach proposes that the notion of customer focus be introduced everywhere in the business.

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One must know specifically, how to achieve total quality. The total quality technology includes a number of methodologies, tools and techniques used at either or both strategic and operational levels.

An attempt must be made to cover TQM techniques from design stage to customer satisfaction measurements. A successful attempt helps to maintain total quality, understand and implement total quality, and move on the road towards total quality. Understanding these issues give fresh ideas for overcoming the barriers to achieving total quality.

**Total Quality waves:** The Total Quality (TQ) wave swept India in early 90s particularly in view of challenges thrown up by unification of European markets post 1992. It is not only the ‘systems’ part of Total Quality (TQ) which makes up Total Quality Management (TQM) but also, predominantly, the management strategy and philosophy which goes alongside total quality approach and the fact that it transcends every functional area and every level of organisation in *quest for never-ending improvement* of products and services thereby impacting quality of human life and even that of business, government and society at large.

Philip B. Crosby, while visiting India in 1979 said that Indian corporate need to treat quality as a core competence in the form of unique bundle of skills gain a competitive edge over rivals in any of business with more focus on external factors than internal factors particularly in government, and services. In India, the need is to have quality leadership in all sectors for a management thought change to meet quality revolution.

TQM refers to companywide quality assurance from supplier to customer (external and internal). Quality does not happen by chance, it has to be managed. Through total quality management (TQM), the total quality can be achieved and maintained.

With this scenario, Indian industries can no longer afford poor quality levels and it is not only that they have to equip themselves with ISO 9000 systems but the strategic - approach must be to integrate operations and marketing efforts.

*It is an ongoing process and there is no limit to striving for excellence in order to attain global competitiveness. In fact, a latest concept of TQM - II has emerged which refers to continuous profitability improvement through Total Quality Management and Movement.*
3.4.1 KAIZEN Philosophy - Continuous incremental improvements

Masaaki Imai, the chairman of the Cambridge corporation, an international management consultancy and executive recruiting firm, based in Tokyo, who founded KAIZEN Philosophy in 1962. Imai has brought together the management philosophies, theories and tools that have been popular in Japan over the years, as a single concept - Kaizen, which as he says, has been responsible for Japan’s economic success. In a working environment, kaizen means continuous process improvement involving everybody. But more generally, the kaizen philosophy advocates ongoing improvement, not only in working life, but also in personal life, home life and social life. The type of improvement kaizen signifies is the constant and gradual improvement, no matter how small, which should be taking place all the time, in every process, involving everyone from all the ranks of management and workforce. The kaizen improvement is by definition a long-term and long lasting improvement, the result of a team effort; it is process-oriented and actually requires little investment, but great effort to maintain.

**Kaizen and innovation:** The kaizen improvement contrasts sharply with the type of the drastic improvement, which is usually the result of innovation. Kaizen and innovation are complementary aspects that both lead to improvement. Top management's responsibility is to maintain a balance between these two. They both are necessary for the survival and competitive success of an organisation. Their main difference lies in the fact that kaizen is process-oriented, whereas innovation is results – oriented.

**The difference in the way of thinking:** There is difference between Japanese and Western way of thinking. In particular, the US economy, fast- growing during the post-war years, chooses the innovation path in order to satisfy the ever-increasing market demands of the times.

Keeping the gains is as important as upgrading the standard. Everything deteriorates as soon as it has been established, and if there is no effort for improvement, loss of gains is inevitable. Kaizen efforts are needed to maintain as well as achieve new levels of excellence. There is a sense of urgency in kaizen, an ongoing effort for change. There is no room for complacency or overconfidence. Everything is considered imperfect and therefore subject to further change. The TQC practice viewed as the high road to kaizen.

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3.4.2 5S - Philosophy: House Keeping: Workplace Improvement

Japanese companies distinguish between Innovation (radical) and Kaizen (continuous) K means literally: Change (Kai), to become good (Zen). The foundation of the Kaizen method consists of 5 founding elements: 1. Teamwork, 2. Personal discipline, 3. Improve moral, 4. Quality circles, 5. Suggestions for improvement. Out of this foundation, these key factors are K arise-Elimination of waste (muda) and inefficiency. Japanese companies follow a simple tool of ‘5-S’.

‘5-S’ is the name of the workplace organisation-methodology that uses a list of five Japanese words namely seiri, seiton, seiso, seiketsu, and shitsuke. It is a structured program to systematically achieve total organisation, cleanliness and standardisation in the workplace. The five primary phases of 5S are: sorting, straightening, systematic cleaning, standardising, and sustaining.'

- ‘Seiri’ refers to sorting of materials; the act of throwing away all unwanted, unnecessary and unrelated materials in the workplace and discard them - Tidiness.
- ‘Seiton’ refers to organising a work place; a place for everything and everything in its place, items in good order so that they can be easily picked for use - Orderliness.
- ‘Seiso’ refers to making cleaning and checking habitual; consists of cleaning up the workplace so that there is no dust on floors, machines, equipments - Cleanliness.
- ‘Seiketsu’ defines the standards by which personnel must measure; and maintain cleanliness, high standard of housekeeping at workplace - Standardised clean up.
- ‘Shitsuke’ denotes the discipline; the commitment to maintain orderliness and to practice the first 4S as a way of life, to train people - Discipline- standardisation.

A well organised workplace results in a safer, more efficient and productive operation, it boosts the morale of the workers, pride in their work and their responsibilities.

The 5S approach is a people- oriented as well as also a practice-oriented approach. Some significant benefits observed at companies practicing 5S approach include:

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44 Sharma Sunil, Total Engineering Quality Management, Macmillan India Ltd., (2003), 100-101

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• Happier employees with high moral,
• Greater people involvement,
• Low employee turnover,
• Increased number of suggestions,
• Better use of floor space,
• Better flow of work,
• Reduction in W-I-P inventory,
• Low machine breakdown rates,
• Increased life of machines and tools,
• Higher safety and low accident rates,
• High yield of materials,
• High product yield.

The importance of workplace improvement cannot be underestimated in the context of bringing about total quality change throughout in a company. Indian corporate sector has started recognising the significance of workplace improvement through methods engineering and other techniques.

The 5S approach; starting from housekeeping is the first step of continuous improvement in a company. It is a base for good housekeeping, which contributes to quality and productivity improvement over a period of time on a continual basis.

3.4.3 Six-Sigma Approaches

Most efforts by US productivity centres today are committed to reinforcing six-sigma principles and lean enterprises in other words these are:

1. Reducing defects
2. Increasing quality
3. Reducing costs, and
4. Serving the customer more efficiently.

Global competition continues to push productivity to the top of the US business agenda and has revitalised America’s efforts to develop and employ the latest and most effective productivity strategies.

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45 Sharma Sunil, Total Engineering Quality Management, Macmillan India Ltd, 95-99
America’s desirable productivity record is, therefore, not so much result of a well-formulated government led effort, but the results of a shared set of values inherent in the business and economic mind set. Those shared values constitute a philosophy that benefits productivity and when combined with productivity techniques such as lean enterprises and six-sigma can generate solid productivity growth.

Softer components of the USA’s successful productivity performance are:

**First is social openness:** The more open in a society is the more impressive will be rewards of productivity.

**Second is commitment to education and training:** Commitment to education and training, distributes rewards for meritorious effort regardless of social standing.

**Third is honesty and transparency:** The relative honesty and transparency in business relations, the expression of the human spirit and creativity so necessary to productivity.

**Fourth is a strong legal framework for business transactions:** Provides consistency and predictability-allowing business to focus on what it does best.

**Fifth is the admiration of the talents:** Those who take risks and spearhead innovation, the universal appeal of rewarding risk takers, some of the world’s best talents.

**Sixth is a global perspective:** Walt Disney was ahead of his time with his vision of “It’s a Small, Small World”. In Japan can be found throughout the productivity literature.

Productivity is greater than the sum of its parts. No doubt the parts are important, but are the holistic nature of productivity and the resulting synergy that give productivity, the ability to improve human lives and reward labour.

The components of productivity – social openness, hard work, educational opportunity, and a global outlook are not – unique to any one country. They do require however, continued recognition and nurturing.

- The six-sigma concept is attributed to Motorola who claim to achieve only 3.4 parts per million (ppm) in terms of defects in all their processes.
The companies like Allied Signal and General Electric started testing six-sigma as quality improvement strategy in 1990 onwards. This becomes a future goal.

In simple words, it means that in the 6σ approach, the value of ‘σ’ (standard deviation of process distribution) is such that six multiples of ‘σ’ on either side, are able to cover the design limits/specifications so well that the process capability is 2.

Process capability ratio is indicated as:

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\frac{Design\ width}{Process\ Width} = \frac{USL - LSL}{UCL - LCL}
\] (3.1)

Where, **USL**: Upper Specification Limit, **LSL**: Lower Specification Limit, **UCL**: Upper Control Limit, **LCL**: Lower Control Limit.

Process capability ratios measure how well the product requirements and process capabilities match, the larger the value of Cp, the better the match between product and process. Assumption is that process is centred mid-way between the specification limits, i.e. there is no shift in process mean.

**Process Capability Index (Cpk):** is used to assess the capability of process when process average is centred on mean. So, Cpk indicates both variation and location of process average over an extended period of time - long-term basis.

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Process\ capability\ index(Cpk) = \text{Min}\left[\frac{\bar{X} - LSL}{3\sigma}, \frac{USL - \bar{X}}{3\sigma}\right]
\] (3.2)

It also means that if process average is equal to mid-point of the specification range, then

\[Cpk = Cp.\]

In a way, process width happens to occupy just half of the design width.

*Preferred values of Cpk are also thus greater than 1. The higher the value of Cpk, lower would be the amount of product, which is outside specification limits. In certifying suppliers, some organisations use Cpk as one element of certification criteria.*

**Taguchi’s index (Cpm):** A capability index can also be calculated around a target-value rather than actual average. This index, called **Cpm or Taguchi’s index**, focuses on reduction of variation from a target-value rather than reduction of variability to meet specifications.
A major reason for quantifying process - capability is that of its application in computing the process- ability to hold product tolerances and to sustain highest industrial productivity.

Therefore, planners try to select processes with process capability well within the tolerance width of the product.

3.4.4 Taguchi’s Philosophy

Taguchi defines quality in a negative way as ‘the loss imparted to society from the time the product is shipped’. This loss would include the cost of customer dissatisfaction, which may lead to a loss of reputation and goodwill for the company. Indeed, apart from the direct loss to the company arising from warranty and service costs, there is an indirect loss due to market - share loss and the increased marketing efforts needed to overcome lack of competitiveness.

Taguchi uses his loss function approach to establish a value base for the development of quality products. The function recognises the need for average performance to match customer requirements, and the fact that variability in this performance should be as small as possible.

According to Taguchi, a product does not cause a loss only when it is outside specification but whenever it deviates from its target value.

This loss can be approximately evaluated by Taguchi’s loss function, which unites the financial loss with the function specification through a quadratic relationship. In general this loss is proportional to the square of the deviation from the target. The loss to society increases as the performance characteristics deviates from the target value.

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L(Y) = \frac{M}{D^2} (Y - t)^2
\]  

(3.3)

In this formula, M is the producer’s loss (in monetary terms), when the customer’s tolerance D is exceeded. It provides the basic formula for the loss function L(Y) and a graphical representation of the loss to society when the performance (Y) of a product deviates from the desired target (t).

The objective of Taguchi’s efforts is process and product - design improvement through the identification of easily controllable factors and their settings, which

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46 Logothetis N., Managing for total quality PHI of India Pvt. Ltd. (1997), 298-299.
minimise the variation in product response while keeping the mean response on target. By setting those factors at their optimal levels, the product can be made robust to changes in operating and environmental conditions.

Thus, more stable and higher-quality products can be obtained, and this is achieved during Taguchi’s parameter-design stage by removing the bad effect of the cause rather than the cause of the bad effect.

Furthermore, since the method is applied in a systematic way at a pre-production stage (off line) to determine cost-effective process conditions, thus saving in costs and wasted products. Hence, helps increasing productivity. Taguchi, however, suggests that consistency is more important to quality than being within tolerance.

He supports the view with the following observations:

- Consistent errors can be more easily corrected than random errors.
- Parts within tolerance – limits may produce assemblies that are not within limits, and
- Consumers have strong preferences for product characteristics near their ideal values.

The smaller the performance variation then better the quality, the better the productivity.

3.4.5 TQM Philosophy

Total Quality Management (TQM) is a set of principles, tools and procedures that provide guidance in the practical aspects of customer focus, quality, continuous improvement (Kaizen) and involvement of all personnel. It helps in the reduction of internal competition, fosters team work and reduces cost. It is based on people and people, who are learning, are more open to improvement, change and risk taking. TQM is a systematic approach to guide an organization to excellence.

It provides new strategies for leadership changes in the organizational culture and improves the quality standards set by the customers. The success rate of TQM is commendable in many industries.

This concept is referred to as Company Wide Quality Control (CWQC) in Japan. TQC has been described as statistical control of quality applied to the total operation of an organisation, including all steps to produce dependable goods and services at a low cost suited to the market. Towards this end, lean producers employ:

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47 Sharma Sunil, Total Engineering Quality Management, Macmillan (I) Ltd., 129-155
• Teams of highly skilled workers at all levels,
• Use highly flexible and increasingly automated machines of general purpose type,
• To produce volumes of products in enormous variety,

Lean production is referred as ‘lean’ because it uses less of everything compared with mass production. It may use almost:
• Half the human effort in factory,
• Half the manufacturing space,
• Half the investment in tools,
• Half the engineering hours to develop a new product in half the time.

Lean producers, set target explicitly on perfection in terms of:
• Continually declining costs,
• Zero defects,
• Zero inventories,
• Endless product variety.

Of course, for most lean producers, these are an endless quest for perfection.

**TQM and ISO 9000:**

ISO 9000 may not be always strategically focused on identifying and satisfying the customer needs, neither may they be necessarily focused on the involvement and empowerment of employees in pursuit of continuous improvement.

TQM is a (never - ending) journey; ISO 9000 is just a milestone. TQM is like a *Three- legged stool* as described by Pike & Barnes (1994) and absence of any leg would destabilise the stool, as clear from figure 3.2.

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TQM talks about integration of technical system with social system – the people ‘in’ and ‘outside’ the organisation. TQM is a management philosophy, which involves integration of people, system and management philosophies like vision, commitment, leadership, and continuous quality improvement. International Organisation defines the term Quality System as follow:

‘The quality system typically applies to and interacts with all activities, pertinent to the quality of a product or service. It involves all phases from initial identification to final satisfaction of requirements and customer expectations.

**Just-In-Time (JIT):** Manufacturing companies implement JIT intending to increase efficiency and productivity. JIT also forces manufactures to improve quality. The objective of a JIT quality programme is to ensure that these parts are of perfect quality and that no waste is incurred in receiving inspection efforts, line part rejections or shutdowns for lack of material. JIT is philosophy which when implemented correctly will permeate every section of the company and change the way in which everyone operates.

The primary goal is to increase the productivity of a manufacturing system by eliminating all kinds of activities that add no value to a product.

**3.4.6 Total productive maintenance (TPM) - The philosophy of zero sums**

TPM philosophy likes to wear a badge, badge that spells out the 3 magic letters in industrial work life. T - for Total, P - for Productive, M – for Maintenance. TPM represents – as the badge proclaims – the following essentials to reach the goal of

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49 GSFC, Training Bulletin, TPM -The philosophy of the zero, XXX III (2), Dec. (1999), 51-60
- High quality minus high costs;
- Self maintained workplaces;
- Elimination of the losses;
- Optimal life and availability of tools;
- Self improvements;
- Short Production development time;
- Low machine life cycle cost;
- Productivity in indirect department;
- Zero breakdowns; Zero defects; Zero accidents; Zero losses.

Total Productive Maintenance (TPM) also means Total Profit Management (TPM), through Total Perfect Manufacture (TPM), to Total People Management (TPM).

Here, machines deliver more units, fewer defects, higher quality and lower trouble then, they do anywhere else. Here, companies extract the utmost from their equipment, destroy costs and boosting margins.

TPM is really about the better utilisation of plants, and getting the real measure of plant efficiency. TPM ensures the total effectiveness of the plant by taking the 3 key aspects of ‘Utilisation, Quality and Downtime’.

The major strength of TPM is that it is more than just a tool. It’s a holistic productivity improvement system that can drive the entire factory and workforce. TPM is not a specific maintenance policy; it is a culture; a philosophy; and a new attitude.

TPM must be part of a clear manufacturing strategy in terms of resources and time a strategy that puts manufacturing at the heart of the company’s drive for productivity.

TPM is another successful technique, which can be made use of by enterprises to gain competitive advantage. It has been successfully implemented at various organisations in India. The following are the main advantages in successful implementation of TPM:

- Increase in Productivity,
- Reduction in defective parts,
- Reduction in maintenance costs,
- Reduction in inventory levels& costs (have come down significantly),
- Increase employees’ involvement / suggestions for improvement in performance.
The author concludes that, productivity has gained new dimensions and it needs more concentration than any other parameter, particularly for the developing countries like India to achieve its place among the largest world economies in time to come.

3.5 Productivity, Quality Management and ISO 9000

In this section, various aspects are reviewed to help drawing useful line of action to help improve performance of industries in the V U Nagar industrial estate, GIDC under study to compete in highly competitive global scenario for survival.

3.5.1 Measure productivity of machines and processes and not men

P. S. Deodhar, in his book “Is anyone out there? - Managing Progress in Chaotic India” illustrates that, globalisation of trade and knowledge driven by the rapid advances in communications and computer technologies has equally, speedily expanded the contemporary social, cultural, and political landscape for every nation. In India, we are witnessing a deep impact of these global events and have been tackling for enduring solutions. The 21st century is still an outstanding opportunity for India and to benefit from it we need to change and that change has to begin with rural young.

Today most western nations have a fast growing aging population and they are worried about the lack of productive youth population. We have 500 million youngsters below the age of 25 and majority is rural poor. It depends on us to turn this into our national resource or make it a liability by ignoring to carefully groom them. If we are smart and careful, these youngsters can prove to be our unprecedented strength, an asset and they could be the most powerful solution to all ills.

Computers are, going to be the agents of change in our life style of tomorrow. A change is never without inconvenience, but we have to get over such hurdles and carefully plan to use computers vary widely, says Deodhar.

Today, computers are directly and effectively linking engineering analysis with product design and manufacture. Popular sentiment is that using computers leads to loss of jobs. Supports computerisation, even at the cost of marginal displacement of jobs in industries where computer control could yield significant benefits in quantity and quality of output.

Computers are amazingly powerful tools but also warn that they are just tools, all the same. Computers will in fact create new jobs in much larger number than the jobs lost, says Deodhar.

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50 Deodhar, P. S., Is anyone out there? Managing Progress in Chaotic India, Thane, India, (2007), 136-139
Indians have made a name for themselves in the world for their IT software skills, focus on education and low cost of skilled manpower has helped India attract profitable business in software services, the prospects for sustained growth very good, Deodar said.

3.5.2 Quality Management - The Indian Scenario:51

Kanishka Bedi, the author, defines Quality Management as a system that serves to control quality in the critical activities of an organisation by bringing together resources, equipment, people, and procedures. It uses techniques and principles such as QFD, the Taguchi method, Service Quality Management, Quality Audits, and Six-Sigma to control quality in every sphere of activity in the organisation.

It is crucial for manufacturing as well as service organisations to implement quality management practices effectively. He says that organisations must also ensure that quality system standards and business excellence models are implemented to make their quality systems stronger and more competitive for survival with higher productivity.

In addition, companies need to implement many more methods of quality management to gain competitive advantage. QM has been gaining importance with globalisation, with corporations expanding their operations to markets. In the Indian context, traditionally, products and services have had a poor quality image in the global market place.

At present, Indian companies have been facing stiff competition from foreign MNCs, both in the domestic and exports markets, and quality is becoming a major differentiating feature in products and services.

After the liberalisation of Indian economy, the Indian customer has gained in terms of better quality products and services offered by both foreign MNCs and domestic companies.

In most instances, Indian managers learnt about the importance of quality while working with their foreign joint venture partners and Indian managers now looking beyond ISO.

In view of the stiff competition and the need for Indian manufactures and service providers to gain a stronghold in the international arena, it has become increasingly important for future managers to be aware of the principles, methods, and latest developments in the field of quality management.

51 Bedi, Kanishka, Quality Management, Oxford University Press, Delhi (2006), iii-iv, 23-28
Kanishka Bedi, the author, chalked out the Indian Scenario. The year 1991 brought about a lot of changes in the Indian economy and the overall business environment in the country. A lot of foreign multinational corporations (MNCs) started operation in India. This has brought about a lot of competition especially from the point of view of the domestic industry. It has become a ‘do or die’ situation for most of the domestic companies, which had been operating, for a long time.

*These organisations have taken proper steps to learn the technical expertise of their foreign partners and make it a way of life.*

Quality is regarded as a more ‘human’ concept than either cost or productivity. As a result this led to a high-cost economy, slow rate of economic growth, growing trade deficit, lower share of the international market, high incremental capital-output ratio, *low productivity*, poor quality, and hardship for the common man - the customer.

The effort on quality improvement will intensify only when it becomes an issue for survival, and that is dependent upon the intensity of fair competition in the market places.

*Hence quality and productivity are closely correlated and two sides of the same coin should run hand to hand and monitored simultaneously to survive in highly competitive scenario of the day.*

### 3.5.3 ISO 9000 – ‘Mantra of improvements’ - A ground reality

Over a decade functioning of ISO 9000 in Indian industrial and service sector has meant drastic *Productivity Improvement and Profits* for some companies. For some it meant sustaining of quality through systematic documentation, systems, and procedures. However, majority of organisations could not achieve any substantial improvement in *Quality* or *Business* results.

*ISO 9000 System, which was started with much big deal for quantum jumps in Quality and Productivity, has lost its charms and it has been reduced to routine paper work.*

*The firm belief is that ISO 9000 certification can be managed by good paper work without improvement on the quality front has had a negative impact on the concept itself.*

Managements desire to get ISO 9000 certificates as quickly as possible either to obtain marketing leverage or to avoid pressures of customers. Others are motivated by fashion of ISO 9000. Yet, another wish to put ISO 9000 certificates, on the walls or on the tables of CEO’s chamber of decorative purpose.
Very few have gone for ISO 9000 certification with real desire of improvements in Quality Productivity and Profitability. In these circumstances if organisations have not improved their business results, it needs not be a surprise to anyone.

- A study of European organisations, which have gone for ISO 9000 reveals that a sustained practice of ISO 9000 have reduced their rejection level, customer complaints, paperwork and rework substantially. It has increased customer satisfactions, team spirit and moral of employees along with profitability by systems and procedures.

- The survey by Confederation of Indian Industries (CII) also indicates similar results in the Indian context. But, here positive result is the more visible with reference to intangibles like team spirit, moral and co-operations rather than business results. They have reported scrap reduction and rejection up to 30 percent by quality planning and quality systems based on ISO 9000 criteria.

Hence, another reality is that the fault is not with system but with people behind the system. Low or no improvements from ISO 9000 system is a result of attitude and intention of the management.

Mr. Anupam Gupta, Manager Certification of STQC (a certifying body) says, ISO 9000 system is better than no system. ISO 9000 can be treated as base line for the improvement, it will act like stopper in deterioration of existing quality level.

*In conclusion, it can say that ISO 9000 system is definitely ‘a mantra for improvements’ in reality. It is a big myth in saying that ISO 9000 is failure and cannot bring improvements. One has to change his perception and utilise properly provision of ISO 9000 for improvements.*

**3.6 Operations Research – A productivity improvement tool**

The author, Panneerselvem says that there is no doubt that a high level of productivity is the single most important factor for the survival of an organisation in today’s intensely competitive business world.

Operation Research is a subject, which deals with the application of optimisation techniques to complex problems arising in direction and management of men, materials, equipment, and money in industry, business and government to achieve

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maximum productivity. In the process of managing various sub-systems of an organisation, executives at different levels have to take several management decisions. They should strive to devise appropriate measures for problem solving, apply scientific techniques to monitor the organisations’ ongoing activities.

For the survival of any organisation, this productivity ratio must be at least 1. If it is more than 1, the organisation is in a comfortable position. All organisations aim at improving this ratio as much as possible. So, the objective of the system is to identify ways and means of improving its productivity and there are several strategies:

- Increased output for the same input,
- Decreased input for the same output,
- Increase in the output is more than the increase in the input,
- Decrease in the input is more than the decrease in the output,
- Increase in the output with decrease in the input.

Thus, operations research is considered to be a tool for the improvement of productivity.

3.7 Adoption of Q.M. concepts amongst Indian manufacturers

The practice of quality management techniques helps companies to improve internal efficiencies and become more competitive. However, this may not be the case in developing countries where the economies are primarily regulated by government policies and the scope of severe competition is restricted. The adoption of quality management concepts and its tools is in transient state in Indian manufacturing. Owing to liberalisation of the Indian economy manufacturing industry is experiencing an increasing pressure for improvement in quality of its products and services, for which it is adopting tools and techniques of quality improvement.

According to a survey (Confederation of Indian Industries, 1995) among ISO 9000 certified companies, 54 percent of 330 respondents stated that there had been an improvement in their product and process quality after obtaining certification. Again study conducted by

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Philipose and Venkateswarlu (1980) showed that only 24 per cent of the Indian manufacturers used control charts while 32 per cent used some type of sampling plans.

In fact, at that particular point of time, quality concepts were limited to the use of acceptance sampling and process control charts. A high 90 per cent of the companies felt that the current attitude of QMP is supportive whereas the remaining 10 per cent that of the companies felt that there has not been any change. Their responses indicate that after the opening of the Indian economy, the focus has shifted to quality and the use of QMPs to face the competition resulting from the entry of MNCs in India.

*It was significant to note that as many as 52 per cent of the respondents are practicing TQM. TQM in India is still in the nascent stage. Until recently there was no market compulsion to embrace modern quality management practices by Indian organisations.*

The authors at the end of this research study have expressed their opinion that Indian manufacturing should focus on the following three important areas in order to establish itself as a strong and competitive sector of the economy.

- The management of manufacturing companies should stress on improving organisational culture then gain in Quality and Productivity be achieved.
- Quality improvement through upgrading of technology should be looked into seriously; world-class quality with obsolete technology can never be achieved.
- Manufacturing companies should be in the lookout for the training and development opportunities that may exist within India and abroad.

### 3.8 Pokka-Yoke: Mistake proofing devices - Zero defects Quality Control

Prevention is better than cure, says the old adage. Nothing could be nearer the truth when it comes to delivering quality. It is possible to avoid the occurrence of the defect itself, through some simple devices. The Japanese call these Pokka - Yoke or Mistake proofing devices. Business everywhere has been striving to attain the goal of “zero defects”.

A defective product or process can occur due to an inherent problem in the machinery or a mistake on the part of the operator. The practice of Pokka-Yoke originated in the Japanese manufacturing community to enhance the quality of products by preventing mistakes in the production line and to improve industrial productivity.

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55 Industry 2.0 Bureau, “Technology Management for decision makers”1(11), May, (2002), 61-62
Mistake can be handled in two ways. Either avoid them completely or repair them immediately. Repairs generally mean re-work, scrap, warranty expenses and so on - which generally entail around 25 percent of the production budget. It may not be practical to expect employees to always deliver error free output.

To err is human variation is bound to occur. Shigeo Shingo, an industrial engineer at Toyota and creator of the Zero Quality Control (ZQC) approach, professed that it would be wiser to help workers “prevent” mistakes than exhort them “to be more careful”.

According to shingo, if causes for error can be avoided, then there is no need for extra efforts to mend defective products.

If mistakes are not allowed into the production line, then there is no question of defects and quality will be high and re-work low. This implies increased customer satisfaction and lower costs, the net results being high customer value.

Pokka-Yoke devices are used to eliminate human error in a process. A Pokka-Yoke device is any mechanism that either prevents a mistake from occurring or makes the mistake obvious at a glance.

**Pokka-Yoke for Prevention** devices are used one of the two methods:

- The *control method* serves a problem and stops a process so that corrective action can take place immediately, thus preventing defects from travelling down the line.
- The *warning method* signals the occurrence of a deviation through a series of buzzers, lights or other warning devices. It signals the operator to remove a defect from the line or make the necessary adjustments to keep the process within control.

The causes of defects lie in worker errors and defects are the results of neglecting those errors. It follows that mistakes will not turn into defects if worker errors are discovered and eliminated beforehand, says Shigeo Shingo.

**Pokka-Yoke works well when corrective action involves trying to eliminate oversights and omissions.**

Mistake proofing helps save cost of materials, labour, time, and increase reliability of the products, widen the market penetration to sky-high, earns customers’ goodwill with good shrink back and productivity to reduce cost of living of the people.
3.9 Japanese Quality – As a part of national identity

Perhaps only in Japan could a television series like Project X have become one of the most popular TV shows. It’s about product quality. More specifically, it’s about a bunch of corporate engineers whose hand-held calculators and ink-jet printers helped turn this nation into an industrial powerhouse. Japan may be losing its edge at a time when South Korea and China are breathing downs its neck.

So it is little wonder that a recent surge in recalls of defective products has set off national hand-wringing and soul-searching, in radio talk shows, on the front pages of newspapers and in the silent corridors of government ministries.

In the US, product recalls occur so frequently that most are barely noticed. But here, they have created something of a crisis in a country where manufacturing quality is part of the national identity. The spate of bad news has not stopped. Just his week, Sony suffered another blow when Toshiba announced, that it was recalling 3, 40,000 Sony - made laptop batteries after last month’s recalls of 5.9 million batteries.

And Toyota, which has experienced a soaring number of recalls in recent years, said on Wednesday that it would hire 8,000 more engineers to strengthen quality.

But Japan is the country that elevated the American quality guru W Edwards Deming to virtual sainthood and dominated global markets with its eminently reliable cars, cameras and computers.

The leading economic daily began a front-page investigative series this month called “Can Japan Protect Quality?”

“Toyota and Sony have been a wake-up call that something is improper in Japan. Japan seems to have lost something important on the way to becoming a developed country, and many Japanese want to get that back”.

3.9.1 Quality Matters - As a matter of pride and a need to survive

In those days of protected economy one could not only survive but even thrive without quality. Money and good profits are all that mattered then. If reaching that goal needs them to pursue quality, they would. Even today, in many enterprises, quality is not the result of attitude or a matter of pride but just a part of a need to survive.

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The global market made it necessary for ISO to define quality and quality systems. It was highlighted that product quality is a result of quality systems followed by an organisation involved in manufacturing as well as the services. The path is chosen simply because customers expect to do so or because a governmental body has made it mandatory. This is the biggest limitation of ISO. The theme was “Good Culture Produces Good Behaviour”.

Japan has used its Buddhist Shinto philosophy combined with American management techniques to bring about a revolution of miniaturization in electronics whereas Germany used its inherent mechanical skills to revolutionize the engineering world. An individual everyone needs to develop attitudes that fill quality both in life and work. The role of people is extremely important in continuous improvement of quality within organisation and hence productivity.

3.10 Case studies: The Total Customer Satisfaction through Quality

In this section world giant companies’ efforts to improve quality and hence performance leading to higher productivity to remain competitive in the era of globalisation are presented, this can be adapted to the industries of the estates.

Case # 1: Motorola’s Quest for Quality

The Total Customer Satisfaction (TCS) worldwide competition shows cases the quality achievements of Motorola teams. All employees are given an equal opportunity to participate, like many companies; Motorola uses teams to solve problems. But Motorola takes it one step further and gives teams the opportunity to compete with one another and share firsthand what they have accomplished, allowing them to see how their achievements impact the organisation through their TCS competition. Winning team members from all over the world are treated like royalty for a few days and are given the opportunity to make a presentation to top executive of the company.

The TCS competition is based on the following objectives:

- Renew emphasis on the participative process at all level of the organization,
- Recognize and reward outstanding performance at the team level;
- Reaffirm the environment for continuous improvement;

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• Demonstrate the power of focused team efforts;
• Communicate the best team achievements throughout Motorola.

In keeping with Motorola’s philosophy of continues improvement, the competition has changed over the years.

**Case # 2: Motorola’s secret to Total Quality Control**

The Galvin Manufacturing Corporation, later renamed Motorola, Inc., began operations on September 25, 1928 in a small section of a rented building at 847 Harrison street in Chicago; the company had five employees. Now in its sixty second years, Motorola is ranked among America’s 150 largest industrial corporations with close to 98000 employees’ worldwide and sales approaching $ 8 billion. In 1988, Motorola received one of the first Malcolm Baldrige National Quality Awards. The secret to Motorola’s success in quality control is focused effort in three major areas:

• Material Control,
• In-process control, and
• Containment.

Within each major area are several key items that must be addressed to achieve success.

**Material Control:** Motorola has substantially improved as its vendors have improved their quality.

**Process Control:** Motorola uses two tools to establish in process controls like; SPC and Process Audits. Virtually all U.S. personnel are being trained in Quality

**Containment:** It means inspecting out defects until permanent corrective actions can be implemented. Statistical sampling plans are used to inspect each lot as it finishes each operation. The sampling plans are based on two items. Each operator then decides either to scrap or to screen the product in question before sending it to the next (station) operation. Screening means that 100 % inspection is performed, and all products that do not meet requirements are scrapped. Rework is not allowed.

The result of the focus on material control, in-process control, and containment is a total quality system that aims for never ending improvement in product quality and that eventually will lead to the ultimate goal of six sigma products.
Case # 3: Motorola’s Six Sigma Quality Concept

When Motorola was awarded the Malcolm Baldrige National Quality Award in 1988, a summary of its quality achievements was distributed as part of an informational packet. That summary contained the following description of Six Sigma Quality. “To accomplish its quality and total customer satisfaction goals, Motorola concentrates on several key operational initiatives. At the top on the list is Six Sigma Quality, a statistical measure of variation from a desire result. In concrete terms, six-sigma translates into a target of no more than 3-4 defects per million products, customer services included. At the manufacturing end, this requires designs that accommodate reasonable variation in component parts but production processes that yield consistently uniform final products. Motorola employees record the defects found in every function of the business, and statistical technologies are increasingly made part of each and every employee’s job.

Case #5: Toyota Motor Corporation - Achieves its high quality and productivity

In setting up New United Motor Manufacturing Inc (NUMMI), Toyota Motor Corporation joined forces with General Motors to revamp GM Plant in California. Even though NUMMI is operating with GM’s workforce, in GM’s building and much of GM’s technology, productivity has sky rocketed because of how managers organized and operate the plant. The NUMMI managers set up a typical Toyota production system with just-in-time delivery and a flexible production line run by teams of workers in charge of their own jobs. Other benefit is that NUMMI now operates with 3100 employees, compared with 5000 at some GM factories and production costs are comparable to Toyota’s cost in Japan. GM executives are making extended visits to learn how the Toyota-managed factory achieves its high quality and productivity.

3.11 Corporate governance for higher productivity59

Adi Godrej, the author of this article defines the corporate governance as efficient supervision, which encourages ‘doing everything better’ and protects the interest of the company while conforming to all established laws and ethics.

At the Godrej Group, the constant effort to improve operational performance, guided by values, forms the basis for good corporate governance. Corporate governance is strongly driven by values such as: Quality, Customer orientation, Commitment, Discipline, Integrity, Learning, Transparency, Respect, Teamwork, and Trust. There is no universal definition of corporate governance. The benefits of having top-notch corporate governance are plenty. The author narrated the following benefits:

- Firstly, good governance provides a competitive advantage in the global market,
- Secondly, governed companies raise capital widely, easily and cheaply,
- Thirdly, governance leads to improved employee morale and higher productivity,
- Fourthly, well-governed companies last longer,
- Lastly, important to remember that ‘the market’ is the definitive compliance officer.

Effective corporate governance is closely linked with corporate performance, human resources management, and the board to increase productivity of the firm. It is the ultimate management tool. Good corporate governance is a ‘journey and not a destination’. It’s a very rewarding journey for those who choose the right path. Above all, corporate governance is both; about doing things right and doing the right thing, says Adi Godrej.

In the ideal scenario, every employee - from the chairman to the shop floor worker- becomes a custodian of the company’s interests. Simple principles are both easy to implement and enforce. Further, simple and moral principles are important to ensure that governance is an aid and not a barrier to business development and enhancing industrial performance and hence the productivity of the organisation.