Chapter-4
SYSTEM OF TOTAL QUALITY MANAGEMENT

After having discussed the Services of quality circle, this chapter shall discuss System of total quality management. The chapter is presented under the following heads.

4.1 Total Quality Management – An Introduction

4.2 Kaizen

4.3 Six Sigma

4.1 TOTAL QUALITY MANAGEMENT – AN INTRODUCTION

Total Quality Management is a management approach that originated in the 1950s and has steadily become more popular since the early 1980s. Total Quality is a description of the culture, attitude and organization of a company that strives to provide customers with products and services that satisfy their needs. The culture requires quality in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations. Total Quality Management, TQM, is a method by which management and employees can become involved in the continuous improvement of the production of goods and services. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices. Total Quality Management (TQM) refers to management methods used to enhance quality and productivity in business organizations. TQM is a comprehensive management approach that works horizontally across an organization, involving all departments and employees and extending backward and forward to include both suppliers and clients/customers. TQM is only one of many acronyms used to label management systems that focus on quality. Other acronyms include CQI (continuous quality improvement), SQC (statistical quality control), QFD (quality function deployment), QIDW (quality in daily work), TQC (total quality control), etc. Like

many of these other systems, TQM provides a framework for implementing effective quality and productivity initiatives that can increase the profitability and competitiveness of organizations. According to Deming (1993), the central problem in management, leadership and production is failure to understand the nature and interpretation of variation. Quality improves productivity and competitiveness. Quality management and improvement are responsibilities of all employees. Concentrate on defect prevention. Low quality and low productivity belongs to the system – improve the system.

4.1.1 Origins

TQM, in the form of statistical quality control, was invented by Walter A. Shewhart. It was initially implemented at Western Electric Company, in the form developed by Joseph Juran who had worked there with the method. TQM was demonstrated on a grand scale by Japanese industry through the intervention of W. Edwards Deming—who, in consequence, and thanks to his missionary labors in the U.S. and across the world, has come to be viewed as the "father" of quality control, quality circles, and the quality movement generally. Walter Shewhart, then working at Bell Telephone Laboratories first devised a statistical control chart in 1923; it is still named after him. He published his method in 1931 as Economic Control of Quality of Manufactured Product. The method was first introduced at Western Electric Company's Hawthorn plant in 1926. Joseph Juran was one of the people trained in the technique. In 1928 he wrote a pamphlet entitled Statistical Methods Applied to Manufacturing Problems. This pamphlet was later incorporated into the AT&T Statistical Quality Control Handbook, still in print. In 1951 Juran published his very influential Quality Control Handbook.

W. Edwards Deming, trained as a mathematician and statistician, went to Japan at the behest of the U.S. State Department to help Japan in the preparation of the 1951 Japanese Census. The Japanese were already aware of Shewhart’s methods of statistical quality control. They invited Deming to lecture on the subject. A series of lectures took place in 1950 under the auspices of the Japanese Union of Scientists and Engineers (JUSE). Deming had developed a critical view of production methods in the U.S. during the war, particularly methods of quality

control. Management and engineers controlled the process; line workers played a small role. In his lectures on SQC Deming promoted his own ideas along with the technique, namely a much greater involvement of the ordinary worker in the quality process and the application of the new statistical tools. He found Japanese executive receptive to his ideas. Japan began a process of implementing what came to be known as TQM. They also invited Joseph Juran to lecture in 1954; Juran was also enthusiastically received. Japanese application of the method had significant and undeniable results manifesting as dramatic increases in Japanese product quality—and Japanese success in exports. This led to the spread of the quality movement across the world. In the late 1970s and 1980s, U.S. producers scrambled to adopt quality and productivity techniques that might restore their competitiveness. Deming's approach to quality control came to be recognized in the United States, and Deming himself became a sought-after lecturer and author. Total Quality Management, the phrase applied to quality initiatives proffered by Deming and other management gurus, became a staple of American enterprise by the late 1980s. But while the quality movement has continued to evolve beyond its beginnings, many of Deming's particular emphases, particularly those associated with management principles and employee relations, were not adopted in Deming's sense but continued as changing fads, including, for example, the movement to "empower" employees and to make "teams" central to all activities.[1] Shewhart has introduced statistical methods to detect assignable causes in a production process. He has developed control charts for production processes. The control chart tells the manufacturer at a glance whether the product has been controlled or not.

4.1.2 Definition

Total Quality management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction. Remember, one happy and satisfied customer brings ten new customers along with him whereas one disappointed individual will spread bad word of mouth and spoil several of your existing as well as potential customers.

The continuous process of reducing or eliminating errors in manufacturing, streamlining supply chain management, improving the customer experience and ensuring that employees is up-to-speed with their training. Total quality management aims to hold all parties involved in the production process as accountable for the overall quality of the final product or service. TQM is a management philosophy that seeks to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc.) to focus on meeting customer needs and organizational objectives. TQM views an organization as a collection of processes. It maintains that organizations must strive to continuously improve these processes by incorporating the knowledge and experiences of workers. The simple objective of TQM is "Do the right things, right the first time, every time." TQM is infinitely variable and adaptable. Although originally applied to manufacturing operations, and for a number of years only used in that area, TQM is now becoming recognized as a generic management tool, just as applicable in service and public sector organizations. There are a number of evolutionary strands, with different sectors creating their own versions from the common ancestor. TQM is the foundation for activities, which include:

- Commitment by senior management and all employees
- Meeting customer requirements
- Reducing development cycle times
- Just in time/demand flow manufacturing
- Improvement teams
- Reducing product and service costs
- Systems to facilitate improvement
- Line management ownership
- Employee involvement and empowerment
- Recognition and celebration
- Challenging quantified goals and benchmarking

- Focus on processes / improvement plans
- Specific incorporation in strategic planning

This shows that TQM must be practiced in all activities, by all personnel, in manufacturing, marketing, engineering, R&D, sales, purchasing, HR, etc.[2]

As per Feigenbaum "quality must be defined in terms of customer satisfaction and determination. Due to the changing needs of customers quality is multidimensional and dynamic". His definition of quality is based on a customer's actual experience with the product or service. Philip Crosby defines quality as conformance to requirements. Quality must be defined in order to manage it. He felt that it is necessary to define quality in order to manage quality. Customer requirements must translate to measurable characteristics for the organization's products or services. He emphasized that effective organizations understand the importance of determining customer requirements, defining those requirements as clearly as possible, and then producing products or providing services that conform to the requirements as established by the customer.

4.1.3 History of TQM

Throughout the history, men have been attempting to find various techniques and methods to bring improvement in quality of the products/services under their control. During the process many quality gurus have tried to build various paths, models approaches, methods, statistical tools and techniques for overall quality building. From this quest for a totality the Total Quality Management (TQM) was born. The TQM and documentation systems in terms of ISO-9000 QMS have also come into existence. TQM seeks to expand the boundaries of quality to solve the problems. Juran is generally recognized as the father of quality, but many quality experts, today, are trying hard to understand the similarities among the quality, quality management, total quality management, quality management system and ISO-9000 documentation so as to finally generate a new theme. The very high performance quality philosophy i.e. TQM that covers right from 'planning' process, on one extreme, to the 'public responsibility' on the others is getting popular in industrial as well as non industrial sectors. In the process of developments, in the area of TQM, a number of pillars within TQM

have been evolved. These include elimination of waste, zero defect, continuous improvement and bench marking. So for as the textile industry is concerned, ISO-9000 QMS certification drive has received considerable worldwide publicity in the past few years. The Government of India too has organized various seminars, conferences, training courses, and projects, in the area of ISO-9000 QMS certification scheme to focus its importance and worth. Recently it has become almost necessary for textile industries, which want to reach the top of quality production in India and which would like to see the actual performance of industrial activities upgraded in the direction of achieving targeted goal, to perform continuous improvement process, benchmarking process and implementation of ISO-9000 QMS. Establishment of quality culture is getting very important task, now days, in almost every walk of industrial lives and this culture can be achieved only through TQM philosophy. This philosophy encourages employees in the organization in different areas namely formation of quality circles, transparency in work assignment, accountability, responsibility, authority, bench marking, education, loss control, profitability and reduction of waste. In today's competitive environment, quality is viewed as more than a function within operations. Quality has grown beyond the scope of operations. Accordingly, Indian textile industries are also implementing TQM philosophy and getting certified their industries by ISO-9000 certificate to improve not only their product and practice, but also the way in which they implement quality. The quality-based philosophy now being adopted throughout the world, termed as Total Quality Management (TQM) is due to Deming.

The history of quality management can be traced all the way back to The Middle Ages. Work completed by journeymen and apprentices were evaluated and inspected by the skilled worker to ensure that quality standards were met in all aspects of the finished product, ensuring satisfaction of the buyer. And while the history of quality management has gone through a number of changes since that time, the end goal is still the same. It was during the 1920's when quality management systems, as we know them today, started to surface. While the focus of quality management was still on the end product, it was the first time that statistical theory was applied to product quality control. Product quality control

was determined through inspections. This involved measuring, examining and testing the products, processes and services against specific requirements to ensure that each element adhered to set standards and guidelines. This algorithm worked for quite some time. Over time, however, businesses began to grow and expand. More and more products were manufactured throughout the day.

Juran identifies three areas for quality conversion within an institution, namely: Financial planning becomes quality planning (developing the products and processes required to meet customer needs), financial control becomes quality control (meeting product and process goals) and financial improvement becomes quality improvement (achieving unprecedented levels of performance)

Companies started to experience difficulties in following through with quality control standards. It became evident that there was a great need for change and development. Change and development were brought forth during the 1940's by industry leaders and experts like Deming, Dodge, Juran and Roming. This would be the beginning of Total Quality Management as we know it today. Inspections were now carried out by production personnel. They were responsible for inspections during specific production intervals. This would change the focus from simply inspecting the end product to actually preventing end product problems through early detection on the production line. It was also during the 1940's that Japan caught wind of Total Quality Management. At that time, Japanese products were considered poor quality imitations. Hearing about the success of quality management in the west, Japan employed the assistance of quality management experts like Deming and Juran. Little did the Western culture know at that time, Japan would soon push the envelope and set new standards in TQM. During the first international quality management conference in 1969, Feigenbaum would first use the phrase Total Quality Management. Feigenbaum, however, would not meet the depth of understanding of the term that Japanese attendee and speaker, Ishikawa would. Ishikawa would indicate during the conference that TQM should apply to all employees within the organization – from the workers to the head management. The Western culture would soon catch up, however. By the 1980's, the Western culture would take notice of Japan's success and start to set and adhere to higher Total Quality Management guidelines.[3]

4.1.4 Principles of TQM

Total Quality Management (TQM) is a management approach focusing on the improvement of quality and performance in all functions, departments, and processes across the company to provide quality services which exceed customer expectations. TQM expands the scope of quality of every department from top management to lower level employees. It enables management to adopt a strategic approach to quality and put more effort on prevention rather than on inspection. Through TQM, all employees are trained in a professional manner and encouraged to make decisions on their own to improve the overall quality and attain higher standards. This is a key to achieving the TQM results desired, because without your employees on board and feeling empowered, you might as well be swimming upstream. Through TQM, companies increase customer satisfaction, reduce costs, and foster team work. Companies can also gain higher returns on sales and investment. The ability to provide quality services allow for higher prices to be charged. Total quality means better access to global markets, greater customer loyalty, wider recognition as a quality brand, etc.

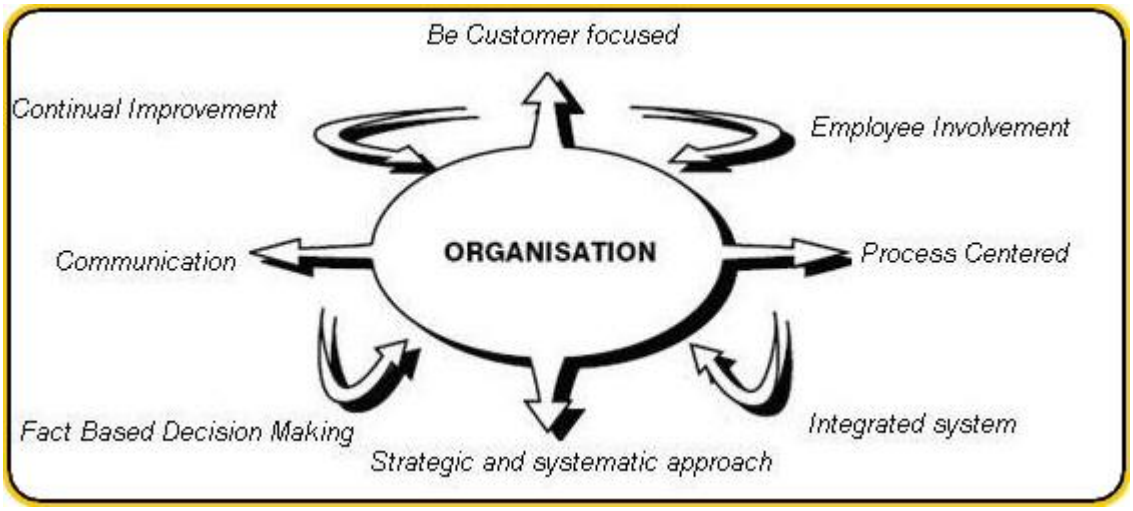

Figure 4.1: Principles of TQM

Source: http://www.bexcellence.org/Total-quality-management.html

TQM is broadly based on the following principles:

i. **Customer Centric Approach** – Consumers are the ultimate judge to determine whether products or services are of superior quality or not. No matter how many resources are pooled in training employees, upgrading machines and computers, incorporating quality design process and standards, bringing new technology, etc.; at the end of the day, it is the customers who have the final say in judging your company. Companies must remember to implement TQM across all fronts keeping in mind the customers.

ii. **Employee Involvement** – Ensuring total employee involvement in achieving goals and business objectives will lead to employee empowerment and active participation from the employees in decision making and addressing quality related problems. Employee empowerment and involvement can be increased by making the workspace more open and devoid of fear.

iii. **Continual Improvement** – A major component of TQM is continual improvement. Continual improvement will lead to improved and higher quality processes. Continual improvement will ensure companies will find new ways and techniques in producing better quality products, production, be more competitive, as well as exceed customer expectations.

iv. **Strategic Approach to Improvement** – Businesses must adopt a strategic approach towards quality improvement to achieve their goals, vision, and mission. A strategic plan is very necessary to ensure quality becomes the core aspect of all business processes.

v. **Integrated System** – Businesses comprise of various departments with different functionality purposes. These functionalities are interconnected with various horizontal processes TQM focuses on. Everyone in the company should have a thorough understanding of the quality policies, standards, objectives, and important processes. It is very important to promote a quality work culture as it helps to achieve excellence and surpass customer expectations. An integrated system ensures continual improvement and helps companies achieve a competitive edge.

vi. **Decision Making** – Data from the performance measurement of processes indicates the current health of the company. For efficient TQM, companies must collect and analyze data to improve quality, decision making accuracy, and forecasts. The decision making must be statistically and situational based in order to avoid any room for emotional based decisions.

vii. **Communications** – Communication plays a crucial role in TQM as it helps to motivate employees and improve their morale during routine daily operations. Employees need to be involved as much as possible in the day to day operations and decision making process to really give them a sense of empowerment. This creates the environment of success and unity and helps drive the results the TQM process can achieve.[4]

viii. It requires immense efforts, time, courage, and patience to successfully implement TQM. Businesses successfully implementing TQM can witness improved quality across all major processes and departments, higher customer retention, higher revenue due to improved sales, and global brand recognition.

The basic principles for the Total Quality Management (TQM) philosophy of doing business are to satisfy the customer, satisfy the supplier, and continuously improve the business processes.

Questions you may have are:

- How do you satisfy the customer?
- Why should you satisfy the supplier?
- What is continuous improvement?

(i) Satisfy the customer

The first and major TQM principle is to satisfy the customer--the person who pays for the product or service. Customers want to get their money's worth from a product or service they purchase.

- Users: If the user of the product is different than the purchaser, then both the user and customer must be satisfied, although the person who pays gets priority.
- Company philosophy: A company that seeks to satisfy the customer by providing them value for what they buy and the quality they expect will get more repeat business, referral business, and reduced complaints and service expenses. Some top companies not only provide quality products, but they also give extra service to make their customers feel important and valued.
- Internal customers: Within a company, a worker provides a product or service to his or her supervisors. If the person has any influence on the wages the worker receives, that person can be thought of as an internal customer. A worker should have the mind-set of satisfying internal customers in order to keep his or her job and to get a raise or promotion.
- Chain of customers: Often in a company, there is a chain of customers, - each improving a product and passing it along until it is finally sold to the external customer. Each worker must not only seek to satisfy the immediate internal customer, but he or she must look up the chain to try to satisfy the ultimate customer.

(ii) Satisfy the supplier

A second TQM principle is to satisfy the supplier, which is the person or organization from whom you are purchasing goods or services.

- External suppliers: A company must look to satisfy their external suppliers by providing them with clear instructions and requirements and then paying them fairly and on time. It is only in the company's best interest that its suppliers provide it with quality goods or services, if the company hopes to provide quality goods or services to its external customers.
- Internal suppliers: A supervisor must try to keep his or her workers happy and productive by providing good task instructions, the tools they need to

do their job and good working conditions. The supervisor must also reward the workers with praise and good pay.

- Get better work: The reason to do this is to get more productivity out of the workers, as well as to keep the good workers. An effective supervisor with a good team of workers will certainly satisfy his or her internal customers.
- Empower workers: One area of satisfying the internal suppler is by empowering the workers. This means to allow them to make decisions on things that they can control. This not only takes the burden off the supervisor, but it also motivates these internal suppliers to do better work.

(iii) Continuous improvement

The third principle of TQM is continuous improvement. You can never be satisfied with the method used, because there always can be improvements. Certainly, the competition is improving, so it is very necessary to strive to keep ahead of the game.

- Working smarter, not harder: Some companies have tried to improve by making employees work harder. This may be counter-productive, especially if the process itself is flawed. For example, trying to increase worker output on a defective machine may result in more defective parts. Examining the source of problems and delays and then improving them is what is needed. Often the process has bottlenecks that are the real cause of the problem. These must be removed.
- Worker suggestions: Workers are often a source of continuous improvements. They can provide suggestions on how to improve a process and eliminate waste or unnecessary work.
- Quality methods: There are also many quality methods, such as just-in-time production, variability reduction etc. that can improve processes and reduce waste.

4.1.5 Components of TQM

TQM is a way of thinking about business processes, people and systems to ensure things are done right first time.

Processes: Each business process is made up of a series of actions that satisfy the customer's needs and expectations. Each area of an organization has many processes. It's key to look at each action – and its result – to assess what you need to do to improve quality. Every organization has large processes called core business processes, such as selling mortgages or designing software. They're made up of a series of small processes. The core business processes must be carried out well if an organization is to achieve its objective of total quality.

People: While a TQM strategy comes from senior management, it's the staffs that carry out the business activities day to day who have true responsibility for performance and quality. Their buy-in is the key, so managers need to make sure they understand the long-term goal of total quality and the reasons for any new ways of working. It's also important to keep staff informed of any improvements they've achieved to provide impetus for further improvements. Staff needs to see commitment from the top down – managers leading by example – and need to feel the whole company is embracing TQM. Managers need to promote the right climate for business improvement, encouraging staff to come up with ideas for innovation and problem solving.

Management Systems: TQM entails a change in company culture and working practices. It's key to have a system in place to manage and sustain these changes. Your company will get the best results if leaders take responsibility for the adoption and documentation of a new management system.

Performance Measurement: To lay the foundations for total quality management, you need to carry out an effective review of how you currently work. A review will highlight bottlenecks, bad service and other quality issues. You need to collect data to measure current performance to use as a benchmark for future performance – to make sure you are achieving the desired level of performance. You should measure performance at all levels in the organization. Techniques such as brainstorming and tools such as cause and effect graphs can help you see which areas are priorities for improvement. As TQM embraces 'soft' issues such as

company culture and how you interact with society, you may want to investigate ways of measuring performance that take soft issues into account.

Customers and suppliers: When looking for ways to improve the quality of services or products for the customer, you need to isolate the weakest link in the chain. Service can be disrupted at any point by the actions of one member of staff or by the failure of one piece of equipment. There is no place for constant failures in an organization that aspires to total quality. To track down the weak spots and bottlenecks, you can use performance measurement – collecting and analyzing data. It can help you establish whether an activity is carried out to the same standard each time or is subject to unacceptable variations. It's important to 'nip in the bud' any failure to meet standards before it impacts the customer, as customer satisfaction is a key part of TQM. To achieve quality throughout an organization, every person in the production process must be encouraged to take a fresh look at who their customers or suppliers are. A customer is not just the end-customer who buys a product or service, but also any department that asks for a task to be done. And suppliers are not just those companies that provide products and services, but also any internal department that supplies a service.

Issues to think about include customers' needs and expectations. Do staffs feel they are consistently meeting expectations, and if not, do they have suggestions for raising their performance? How much more effort would it take to exceed customer expectations? It's also important to monitor changes in customer expectations, to keep ahead of the game. Staff that deal with suppliers need to ask: is the supplier meeting my needs and expectations? If the answer is negative, staff need to take a fresh look at the way they communicate their requirements – are they keeping suppliers up to date with changes to requirements? Many companies find that the more information they share with customers and suppliers, the better the relationship and the easier it is to smooth out quality and supply issues. The ideal is an open partnership, where both parties share responsibility and benefit from greater co-operation.

Commitment, communication and culture

Commitment: TQM must start at the top with commitment from the board. Senior managers must consistently demonstrate their commitment to quality. Middle managers must ensure they communicate the principles and benefits to the people who report to them. This will lay the right foundations for a company-wide commitment to quality. Companies need a sound quality policy, supported by plans and resources to implement it. Leaders must take responsibility for preparing, reviewing and monitoring the policy – and this is an ongoing responsibility. Managers must ensure everyone understands – and signs up to – the quality policy.

Communication: Effective leadership starts with the development of a mission statement, followed by a strategy, which is translated into action plans through the organization. These, combined with a TQM approach, can produce a quality organization, with satisfied customers and good business results. Key requirements for effective leadership include:

- Developing and promoting corporate beliefs and objectives, often in the form of a mission statement or company vision;
- Acting as role models for a culture of total quality;
- Developing effective strategies and plans for achieving total quality;
- Reviewing the quality management system;
- Communicating the quality message and motivating staff to sign up for total quality.

As leadership is 'key', we've included a list of pointers from TQM gurus on the topic:

- The organization needs to commit long term to continuous improvement.
- Adopt a 'right first time' culture.
- Help staff to understand customer/supplier relationships.
- Do not judge suppliers on price alone – look at the total cost.
- Adopt modern management methods and empower staff – eliminate fear in the workplace.

- Break down barriers between departments by improving communications and teamwork.

Culture: The culture in any organization is made up of prevailing beliefs, norms and rules. Any new corporate strategy that fails to take into account the company culture will have a hard time establishing itself. If you understand why staffs do things in a certain way, it can help you successfully map the steps to change. Most companies recognize that they need co-operation at all levels, and a culture of good teamwork, to drive through major change.[5]

4.1.6 Stages of TQM Implementation

Dale et al, (1994) identified six different levels of TQM implementation, these includes uncommitted, drifters, tool pushers, improvers' award winners and world class. According to them, these stages do not necessarily represent the stages through which organisations pass on their TQM journey. These levels according to Dale et al are to help organisation in identifying their weaknesses and proffering solutions to them through the use of continuous improvement.

Uncommitted: This stage represents organisations that have not started a formal procedure of quality improvement. Organisations in this stage view quality improvement as an added cost and thus have no investment in quality improvement programmes such as training of employees. Organisations in this stage are termed uncommitted because they are not aware of the benefit of quality improvement and lack an appropriate quality improvement plan (Dale et al, (b) 1994). The management of these organisations is characterized by an emphasis on return of sales and net asset employed.

Other common features of this level as highlighted by Dale et al (1994), this includes:

- A major concern for meeting sales target.
- Employees show little or no concern for quality.
- Full inspection of materials is carried on incoming material and at strategic points during the process of production.

- Lack of communication among the various units of production even between the top management and front line employees.
- Minimal contact with customers.

Drifters: These are organisations that have engaged in a process of quality improvement for up to three years and have followed the available advice and wisdom of TQM. The management of the organisations in this stage tends to review the performance of the firm based on the implementation of TQM and expect immediate gains from it. These organisations view TQM as a programme rather than a process thus making the policy have a low profile among employees. Dale et al ((b) 1994) noted that organisations with such an approach to management are termed drifter because they drift from one programme to the other in a start stop fashion with concepts, ideas and initiative being reborn and re-launched under different guises. Organisations which fall within this stage usually have no plan for the deployment of TQM philosophy throughout the organisation thus limiting the implementation of TQM to the managers while leaving the shop floor out of the implementation process.

Tool pushers: Organisations in this category look at quality improvement programs but in most cases fail to use such tools appropriately. They adopt quality management tools such as quality cycles, quality improvement groups. These organisations often blame the failure of TQM on the tools adopted. Dale et al (1994,) explained that organisations in this stage find it difficult to sustain the momentum of its improvement initiatives and it is continually on the lookout for new ideas. Some characteristics of the drifters includes –

- A major concern for meeting sales target.
- Solving current problems rather than future problems
- Non commitment of every senior management to TQM
- TQM does not operate in every facet of the organisation.
- Companies under this category are more experienced in quality improvement when compared with the drifters.

Improvers: Organisations in this category have engaged in a process of quality improvement for between five and eight years and during this time made important advances (Dale et al,(1994). They understand that total quality involves long term cultural change and have recognized the importance of cultural change and the importance of quality improvement. Dale et al, (1994) explained that organisations in this category are termed improvers because they are moving in the right direction and have made significant progress but still have a long way to go. This is because the implementation of TQM is dependent on a few managers to sustain the drive and direction of the improvement strategy.

Award Winners: These organisations are termed award winners because they have attained a point in their TQM maturity where the kind of culture, values and trust capabilities relationship and employee involvement has become total in nature and encompasses the whole organisation (Dale et al, 1994). In these type of organisation every member of staff recognizes the importance of quality and all effort is made to maintain a quality standard. True competition based on product or service quality can only be attained when an organisation has gotten to a stage where it can compete for awards. Organisations in this stage are believed to have manned the process of quality improvement as the organisations have all it takes to achieve greater heights.

World class: These organisations are characterized by the total quality improvement and business strategies to the delight of customers. The organisations that have attained this stage are always in search of opportunities to improve their services to satisfy customers. It was further explained that the focus of TQM here is on enhancing competitiveness by influencing the perception of customers to the company through the continuous innovation of the service offering. The impact of TQM is felt more here as it is aimed at continuous improvement to enhance customer appeal. The task of satisfying customers is a goal for everyone in the organisation.[6]

4.2 KAIZEN

Kaizen is a Japanese management strategy that means “change for the better” or “continuous slow improvement, a belief that all aspects of life should be

constantly improved (from the Japanese words “kai” means continuous or change and “zen” means improvement, better). The Japanese way encourages small improvements day after day, continuously. The key aspect of Kaizen is that it is an on-going, never-ending improvement process. It's a soft and gradual method opposed to more usual western habits to scrap everything and start with new. In Japan where the concept originated, kaizen applies to all aspects of life, not just to the workplace.

Kaizen is the word that was originally used to describe a key element of the Toyota Production System that means "making things the way they should be" according to the basic, sensible principles of profitable industrial engineering. It means creating an atmosphere of continuous improvement by changing your view, your method and your way of thinking to make something better. In use, Kaizen describes an environment where companies and individuals proactively work to improve the manufacturing process. The kaizen system is based on incremental innovation, where employees are encouraged to make small changes in their work area on an ongoing basis. The cumulative effect of all these little changes over time can be quite significant, especially if all of the employees within a company and its leaders are committed to this philosophy. Improvements are usually accomplished at little or no expense without sophisticated techniques or expensive equipment. Instead of sinking more money in buying machinery, Kaizen veers an organization towards paying attention to small but significant details. Managers are encouraged to improve the efficiency of existing infrastructure instead of investing in more of the same.

Imai has explained the essence of kaizen in simple and straight forward manner. Kaizen means improvement. Moreover, kaizen also means ongoing improvement involving everyone, including both, managers and workers. Masaki Imai stated that, workers be given the freedom to innovate at shop floor without breaking rules and regulations and also without expectation of rewards.

Kaizen focuses on simplification by breaking down complex processes into their sub processes and then improving them. The driving force behind kaizen is dissatisfaction with the status quo, no matter how good the firm is perceived to be.

Standing still will allow the competition to overtake and pass any complacent firm. The act of being creative to solve a problem or make an improvement not only educates people but also inspires to go further.[7]

The fundamental idea behind kaizen comes straight from the Deming's PDCA cycle:

- Someone has an idea for doing the job better (Plan)
- Experiments will be conducted to investigate the idea (Do)
- The results evaluated to determine if the idea produced the desired result (Check)
- If so, the standard operating procedures will be changed (Act)

Kaizen is a system that involves every employee, from upper management to the cleaning crew. Everyone is encouraged to come up with small improvement suggestions on a regular basis. In the first stage, management should make every effort to help the workers provide suggestions, no matter how primitive, for the improvement of the worker's job and the workshop. This will help the workers look at the way they are doing their jobs. In the second stage, management should stress employee education so that employees can provide better suggestions. To enable workers to provide better suggestions, they should be equipped to analyze problems and the environment. This requires education.

Main subjects for suggestions are, in order of importance:

- Improvement in one's own work
- Savings in energy, material, and other resources
- Improvement in the working environment
- Improvements in machines and processes
- Improvements in tools
- Improvements in office work
- Improvements in product quality

- Ideas for new products
- Customer services and customers relations
- Others

Kaizen is based on making changes anywhere improvements can be made. Western philosophy may be summarized as, "if it isn't broke, don't fix it." The Kaizen philosophy is to "do it better, make it better, and improve it even if it isn't broken, because if we don't, we can't compete with those who do." For example, Toyota is well-known as one of the leaders in using Kaizen. In 1999 at one U.S. plant, 7,000 Toyota employees submitted over 75,000 suggestions; out of them, 99% were implemented.

4.3 SIX-SIGMA

Six-Sigma is a set of techniques and tools for process improvement. It was introduced by engineer Bill Smith while working at Motorola in 1986. Jack Welch made it central to his business strategy at General Electric in 1995. Today, it is used in many industrial sectors. Six-Sigma seeks to improve the quality of the output of a process by identifying and removing the causes of defects and minimizing variability in manufacturing and business processes. It uses a set of quality management methods, mainly empirical, statistical methods, and creates a special infrastructure of people within the organization, who are experts in these methods. Each Six-Sigma project carried out within an organization follows a defined sequence of steps and has specific value targets, for example: reduce process cycle time, reduce pollution, reduce costs, increase customer satisfaction, and increase profits. Six-Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services.

4.3.1 Features of Six-Sigma

- Six-Sigma's aim is to eliminate waste and inefficiency, thereby increasing customer satisfaction by delivering what the customer is expecting.

- Six-Sigma follows a structured methodology, and has defined roles for the participants.
- Six-Sigma is a data driven methodology, and requires accurate data collection for the processes being analyzed.
- Six-Sigma is about putting results on Financial Statements.
- Six-Sigma is a business-driven, multi-dimensional structured approach for Improving Processes, Lowering Defects, Reducing process variability, Reducing costs, Increasing customer satisfaction, Increased profits etc.

The word Sigma is a statistical term that measures how far a given process deviates from perfection. The central idea behind Six-Sigma: If you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible and specifically it means a failure rate of 3.4 parts per million or 99.9997% perfect.

4.3.2 Key Concepts of Six-Sigma

At its core, Six-Sigma revolves around a few key concepts.

- Critical to Quality: Attributes most important to the customer.
- Defect: Failing to deliver what the customer wants.
- Process Capability: What your process can deliver.
- Variation: What the customer sees and feels.
- Stable Operations: Ensuring consistent, predictable processes to improve what the customer sees and feels.
- Design for Six-Sigma: Designing to meet customer needs and process capability.

  Six-Sigma focuses first on reducing process variation and then on improving the process capability.

4.3.3 Six-Sigma Roles and Responsibilities[8]

Six-Sigma roles are primarily divided into two segments:

1. Initiative Leadership

2. Project Leadership

Apart from the above two segments, the overall Six-Sigma methodology requires the following roles:

i. Six Sigma Deployment Leader

ii. Six Sigma Champion

iii. Six Sigma Master Black Belt (MBB)

iv. Six Sigma Black Belt (BB)

v. Six Sigma Green Belt (GB)

vi. Six Sigma Yellow Belt (YB)

	Initiative Leadership	Project Leadership
Six Sigma Deployment Leader	X	
Six Sigma Champion	X (within specified area)	X
Six Sigma Master Black Belt (MBB)	X (within specified area)	X
Six Sigma Black Belt (BB)		X
Six Sigma Green Belt (GB)		X
Six Sigma Yellow Belt (YB)		X

Fig.4.2: Six Sigma Project Roles

Source:http://www.sixsigmainstitute.org/Six_Sigma_Roles_And_Responsibilities.php

4.3.4 Six-Sigma Deployment Leader:

As a group, business leaders must own and drive Six-Sigma by doing the following:

- Establish business objectives and the role of Six-Sigma to achieve those goals.
- Create an environment which enables success including goals, measures, coaching, and communication, among others.

- Actively participate in Six-Sigma activities and projects.

Success of the effort is very highly correlated to the interest and time invested by business leaders.

Deliverables of a Six-Sigma Deployment Leader:

- Six-sigma strategy and roll-out plan for the overall organization
- Hire team of Master Black Belt, Black Belts, among others
- Work with MBB to identify organization vision and mission
- Provide a goal for the organization to drive Six-Sigma at all levels

Benefits of being a Six-Sigma Deployment Leader for Organization and for self-career:

- Six-Sigma Deployment Leader helps the organization to develop the Six Sigma culture and helps nurture a culture of continuous process improvement.
- Driving Six-Sigma in the organization allows the deployment leader to run the company to its full potential, thus, leveraging him/her the additional budget for taking more initiatives.

4.3.5 Six-Sigma Champion:

Project Champions (Sponsors) are the managers of the business, function, or value stream which has been identified as high priority for a Six-Sigma team. They play a pivotal role in that they own the processes of the business and, therefore, must ensure process improvements are captured and sustained. They typically also manage Six-Sigma Green Belts (GB's) and must understand the challenges faced by GB associates (for example, removing roadblocks). They also must work with BB's and MBB's to ensure that their business area has developed, and is implementing, a long-term vision of a Six-Sigma operating environment across the entire operative base.

Some more details and associated deliverables on the role of Six-Sigma Champion (Sponsor):

- **Training:** Sponsors must participate in available Six-Sigma trainings.
- **Support:** Provide visible support for Six-Sigma MBB, BB and GB's and provide access to resources needed to conduct the project.
- **Scope:** Set very clear scope for all Six-Sigma projects. Ensure that the project is clearly defined, has a scope which can be managed within 4-6 months, and which has high likelihood of success. Watch the project as it progresses to ensure that the scope stays strictly within the bounds originally set.
- **Expectations:** Set high expectations on the value of the results. Ensure the goals are not sub-optimized. The Six-Sigma process has proven in many cases to deliver value far beyond initial estimates. Less-than-aggressive goals will yield less-than-aggressive results.
- **Facts:** Challenge Experts on their Knowledge of facts and the basis of their conclusions.
- **Involvement:** Sponsors are expected to interact with project teams on a regular basis to participate in problem solving, make decisions, and allocate resources. Plan to spend at least 2 hours every other week with the project team.
- **Hand-over:** Sponsors will be responsible for ensuring that the business takes ownership of the implementation and delivers the value indicated in the Control phase. This requires a specific individual who will own the delivery of the project metrics.
- **Results:** Sponsors, as well as six-sigma mentors and business controllers, are responsible for ensuring that project results hit the bottom line of the organization.

Benefits of being a Six-Sigma Champion (Sponsor) for Organization and for self-career:

- Champions set the direction of process improvements in the organization. They link the benefits of the project to organizational priorities.

- Champions can create a portfolio of projects which could range from projects in Customer Satisfaction, Service, Cost and Quality. It provides the Champions the visibility in the process and also showcases his abilities to top-management to manage varied portfolio of projects.

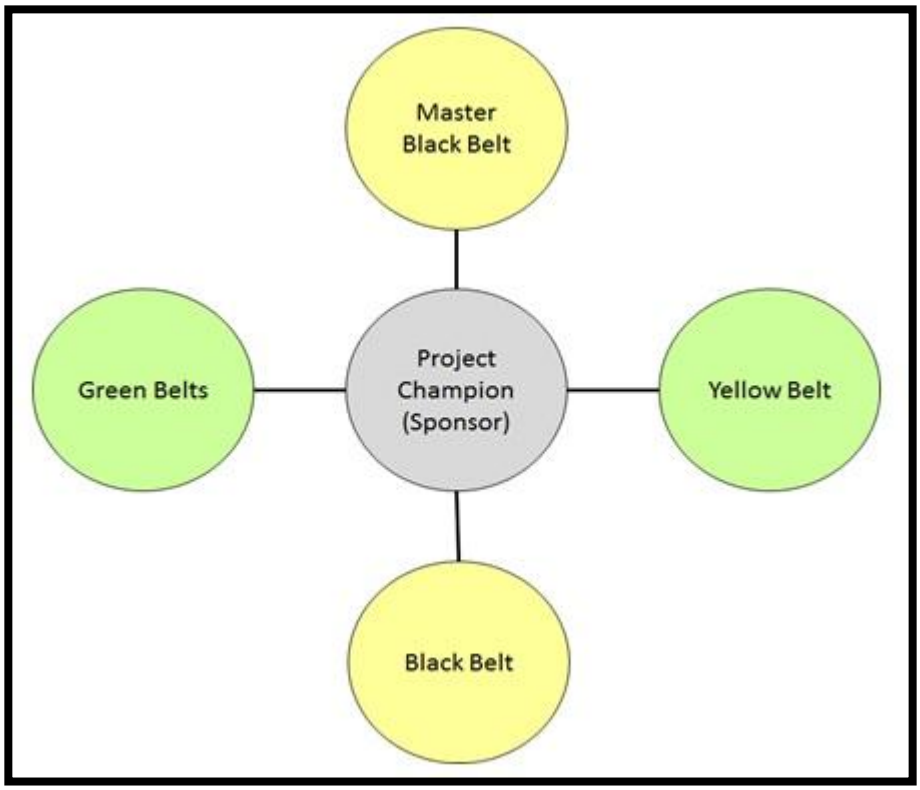

Fig.4.3: Six Sigma Interacting Roles

Source: http://www.sixsigma-institute.org/Six_Sigma_Roles_And_Responsibilities.php

4.3.6 Six-Sigma Master Black Belt (MBB):

These individuals are responsible for translating the high level business goals into a Six-Sigma strategy for the division and the supporting tactics. They work with the deployment leader to achieve the former. They also lead the development of the Six-Sigma skills in the organization, for Black Belts, Green Belts, and the general associate base. MBB's have ultimate responsibility to ensure the quality, value, and sustainability of Six-Sigma projects under their guidance.

MBB's are responsible, together, for the success of the overall Division's Six-Sigma effort. They coordinate and lead activity on key cross-division value streams (e.g. Customer Service, Cycle Time, Research, etc). They also ensure that

a culture that values openness, creativity and challenging the status quo develops in the organization.

Taguchi proposed a method with a key step of parameter design. The objective of parameter design is to optimize the setting of process parameter values for achieving high quality with low cost. Furthermore Shingo has-studied methods of quality control when observation- vectors are coming from multivariate binomial or multivariate poison population. He has proposed a method for translating when a sample covariance matrix is singular in to a non singular estimate under the assumption of conditional independence.

Deliverables of a Master Black Belt:

- Six-sigma strategy and roll-out plan in the organization/function
- Manage Project of the function
- Mentor Teams
- Achieve Lean Six-Sigma Results
- Cross-Functional Leadership
- Project Execution and Removing Roadblocks

Benefits of being a Master Black Belt for Organization and for self-career:

- MBB helps to set the culture of Six-Sigma right from the grass-root level in the organization.
- Black Belts are benefited due to the mentoring and statistical skills of MBB.
- MBB can grow up the ladder and become the Chief Quality Officer as he gains experience and expertise in the field of Six-Sigma.

4.3.6.1 ***Six-Sigma Black Belt (BB)*****:** Six-Sigma BB's are full-time/part time project leaders and mentors of the business, including Green Belts and other associates. They have tactical responsibility for executing specific projects and ensuring that the results are captured, the changes are owned by the Champions (Sponsors), and the changes are sustained. They will also lead Six Sigma knowledge transfer to both full- and part-time participants. BB's are expected to create an environment

of open, honest debate of facts. They challenge the status quo where appropriate and share (and seek) ideas across boundaries

Deliverables of a Black Belt:

- Six-sigma strategy and roll-out plan for the given process/area
- Execute Projects
- Help and guide Project Resources/ Help remove project level Barriers
- Team and Project Structuring
- Six-sigma Project Results
- Mentor Green Belts
- Share Best Practices

Benefits of being a Black Belt for Organization and for self-career:

- BB's are responsible for taking the process improvements to the next level in the organization.
- BB's are highly trained on improving results for the organization using statistical analysis and Six-Sigma tools. Hence, they have a very lucrative career path ranging from Business Analysts to Process Improvement experts.

4.3.6.2 *Six-Sigma Green Belt (GB)*: Six-Sigma Green Belts are the engine of Six Sigma projects. Black Belt's support the efforts of the broader business teams to identify and implement change. The GB's are part-time Six-Sigma Project Leaders. They are responsible for scoping the projects, leading the project team, calling for help when needed, managing interfaces with business leaders, and ensuring sustainable results. The goal of GB's is to translate the value of Six-Sigma to the specific work environment and problems.

Deliverables of a Green Belt:

- Project Execution
- Team and Project Structuring
- Six-Sigma Project Results

- Share Best Practices

Benefits of being a Green Belt for Organization and for self-career:

- GB's have authority in their respective processes and can get the work done effectively. This is a very critical aspect for the organization as it builds its process improvement structure within each process.
- For self-career, GB's receive exposure to senior management directly by virtue of the projects and get the opportunity to make a difference in the organization.

4.3.6.3 ***Six-Sigma Yellow Belt (YB):*** These are the project-specific, full-or part-time resources that provide process and cross-functional knowledge, as well as help to sustain the gains. They have co-ownership of the project with the Six-Sigma Experts and are responsible for the quality of the work and results. This team also plays the critical role of translating the process gains from Six-Sigma to other areas of the business after the specific project has been completed. This is the true leverage of Six-Sigma methodology!.

Deliverables of a Yellow Belt:

- A Yellow Belt has basic knowledge of Six-Sigma
- They do not lead projects on their own, as does a Green Belt or Black Belt.
- YB participates as a core team member or subject matter expert (SME) on DMAIC project or projects. Supports Green Belt or Black Belt in developing process maps, helping with data capture, facilitating simulation, and improvements.
- YBs may often be responsible for driving smaller process improvement projects using Lean tools or best practice sharing in their processes.

Benefits of being a Yellow Belt for Organization and for self-career:

- For any project, Yellow Belts are those individuals who are the Subject Matter Experts (SME's) of their respective processes and also have the basic know-how of Six-Sigma. They are the spokes of a wheel and can help drive any Six-Sigma process to closure by using their process expertise.

Organizations can greatly benefit by choosing the right YB's for the right projects.

- For self-career, YB's get exposure of channelizing their Subject knowledge to process improvement opportunities yielding tremendous benefits for self understanding.

Summary: This chapter focuses on the contributions made by Japanese quality gurus in the area of TQM. This chapter also contains basic concept of TQM, historical review and its principles. Six-sigma and kaizen are very neatly explained in this chapter.

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