TOTAL QUALITY MANAGEMENT
KEY CONCEPTS

ANSH JOSHI

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ISBN: 978-93-5496-658-3

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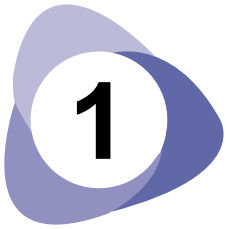

INTRODUCTION

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1.1 Need for quality

Introduction

Total Quality Management is a management approach that originated on 1950s and has steadily become more popular since the early 1980s. Total Quality is a description of the attitude, culture and organization of a company that strives to provide customers with service and product 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, is a method by which management and employees will become involved in the continuous improvement of the production of best and services. It is a combination of quality and management tools aimed at raising business and reducing losses due to wasteful practices.

Need for quality

One of the important issues that business has focused on the last two decades is **quality**. The other issues are cost and delivery. Consumers only buy the goods which meet their requirements and expectations with best quality and accepted price.

Quality has been widely considered as a key element for success in the present competitive market. Quality refers to meeting the required and expectations of customers. It is important to understand that quality is about more than a product simply working properly.

Quality refers to certain standards and the ways and means by which those standards are achieved, maintained & improved. Quality is not just confined to products and services. It is a homogeneous element of any characteristic of doing things with high degree of improvement. For example, Business success depends on the quality decision making.

1.2 Evolution of quality

The history of total quality management began initially as a term coined by the Naval Air Systems Command to describe its Japanese-style management approach to quality improvement.

An umbrella methodology for continually improving the quality of processes, it draws on knowledge of the principles and practices of

- The analysis of quantitative and non-quantitative data
- Process analysis
- The behavioral sciences
- Economics theories

Evolution of Quality

1.3 Definitions of quality

1. Predictable degree of uniformity and dependability at low cost and suited to the market - **Deming**

2. Conformance to requirements - **Crosby**

3. Fitness for use- **Juran**

4. Minimum loss imparted by a product to society from the time the product is shipped - **Taguchi**

5. Correcting and preventing loss, not living with loss – **Hosffin.**

6. A way of managing tile organization - **Feigenbaum**

7. The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs – **ISO**

Let us see how the quality be quantified

Quality is quantified as

$$Q=\frac{P}{E},$$

Q - Quality

E - Expectations

P - Performance

If Q is greater than E, then the customer has a good feeling about the product or service.

Quality planning:

The quality planning is the strategy planning process in which quality is embedded in each and every step. Quality planning can be applied for the following levels:

1. Supervisory and worker level

2. Multi levels

3. Functional levels

4. Major programming level

1.4 Dimensions of product and service quality

Dimensions View of Quality:

Quality has nine different dimensions.They are as follows:

- Conformance
- Aesthetics
- Response
- Service

- Performance
- Reliability
- Durability
- Features
- Reputation

Following Table shows these nine dimensions of quality with their meanings and explanations in terms of a cell phone.

S.No.	Dimension	Meaning and Example
1.	Performance	Primary operating characteristics of a product such as signal coverage, audio quality, display quality, etc.
2.	Features	Secondary characteristics such as added features like calculators and alarm clock features.
3.	Reliability	The probability of a product's failing with a specified period of time.
4.	Conformance	Meeting specifications or industry standards, workmanship or the degree to which a product's design or operating characteristics match pre established standards.
5.	Durability	It is a measure of product's life having both economic and technical dimensions.
6.	Service	Resolution of problem and complaints, ease of repair.
7.	Response	Human to Human interface.
8.	Aesthetics	Sensory characteristics like exterior finish.
9.	Reputation	Past performance and other intangibles.

These dimensions are somewhat independent. Therefore a product can be excellent in one dimension and average or poor in another. Rarely very few products excel in all nine dimensions.

For example, the famous Japanese high quality cars, in the 1970s are based only on the dimensions of reliability, conformance and aesthetics. Therefore, quality products can be determined by using a few of the dimension of quality.

Service Quality: It is the set of activities an organization uses to satisfy the customers and their needs.

Dimensions of Service Quality:

1. Reliability: It refers to the dependability of the service providers and their ability to keep their promises.

2. Empathy: It is being able to understand the needs of the customer as an individual and meet the special requirements of the customer.

3. Responsiveness: It refers to the reaction time of the service. It is the willingness to help the customer promptly in case of special and unforeseen requirements.

4. Assurance: It refers to the level of certainty a customer has regarding the quality of the service provided. It is the extent to which the service provider and the staff is able to inspire trust and confidence.

5. Other Dimensions:

• Time

• Consistency

• Completeness

6. Tangible: It refers to services look or feel. It is similar to the physical characteristics of quality of product. This refers to the physical characteristics of facilities, equipments, consumable goods and personnel used in or associated with service provided.

1.5 Basic concepts of TQM

TQM is the management approach of an organization, centered on good quality based on the participation of all its members and aiming at long-term success through customer satisfaction and benefits to all members of the organization and to society.

TQM is the management philosophy that seeks to integrate all organizational functions to focus on meeting customer needs and organizational objectives.

Total quality management views an organization as a collection of processes. It maintains that organizations must strive to continuously improve the processes by incorporating the knowledge and experiences of workers. The simple objective of Total quality management is "Do the right things, right the 1st time, every time." Total quality management is infinitely variable and adaptable. Although originally applied to the manufacturing operations and for a number of years only used in that area, Total quality management 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. Total quality management is the foundation for activities, which include:

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

1. Focus on the customer:

Achieving customer satisfaction is the heart of Total quality management. Customers include both internal and external customers. So, focus on the customer is the key for any Total quality management programme.

2. Top management commitment:

Top management should participate completely.

3. Continuous improvement:

Total quality management is based on the quest for progress and improvements in Total quality management believes that there is always a better way of doing things, way to make better use of the company's total quality resources and a way to be more productive. For this purpose, various quality tools and techniques may be used.

4.Effective involvement and utilization of the entire work force:

This concept is sometimes referred as 'principle of employee's involvement' or 'respect for people'. Total quality management is a team work. Total quality recognizes that each person is responsible for the quality of his work and for the work of the group.

All persons must be trained in Total quality management, Statistical Process Control and other appropriate quality improvement skills so that they can effectively participate on quality teams.

5. Establishing performance measures for the process:

Quantitative data are necessary to measure the continuous quality improvement activity. Therefore, performance measures such as up time, productivity, sales turnover, absenteeism, percent nonconforming, customer satisfaction, etc., must be determined for each functional area. These results can be used for further improvement activities.

6.Treating suppliers as partners: Since the suppliers influence the company's quality, therefore a partnering relationship should be developed between the all management and the suppliers.

Elements of Total quality management:

I. TQM principle and practices:

1. Leadership

2. Customer focus

3. Employee involvement

4. Supplier partnership

5. Continuous process improvement

6. Performance measures

II. TQM tools and techniques:

1. Seven Tools of quality

2. Six signs

3. Bench marking

4. FMEA

5. QFD

6. TPM

Total quality management is mainly concerned with continuous improvement in all work, from high level strategic planning and decision-making, to detailed execution of work elements on the shop floor. It stems from the belief that mistakes can be avoided and defects can be prevented. It leads to the continuous improving results, in all aspects of work, as a result of continuously improving capabilities, people, processes, technology and machine capabilities.

Continuous improvement must deal not only with improving results, but more importantly with improving capabilities to produce better results in the future. The five major areas of focus for the capability improvement are demand generation, supply generation, technology, operations and people capability.

A central principle of Total quality management is that mistakes may be made by people, but most of them are caused or at least permitted, by faulty systems and processes. This means that the root cause of such mistakes may be identified and eliminated and repetition can be prevented by changing the process.

There are three major mechanisms of prevention:

1. Preventing mistakes from occurring.

2. Where mistakes recur, stopping production until the process can be rectified, to prevent the production of more defects.

3. Where mistakes can't be absolutely prevented, detecting them early to prevent them being passed down the value-added chain.

Benefits of Total quality management:

• Improved the product quality.

• Improved the productivity.

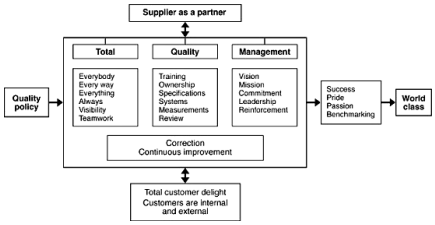
• Reduced the quality costs.

• Increased profitability.

1.6 TQM Framework

The various factors which constitute the frame work of Total quality management are

- The philosophical elements
- Tools of the QC department
- The generic tools



TQM Framework

1.7 Contributions of Deming, Juran and Crosby

Deming's Philosophy on TQM:

To plan, Deming counsels that business should design quality products and services that customers want, develop processes and systems that reduce waste and increase quality & reduce the cost of production. Deming wanted to revolutionize the way Beefy's Burgers produces burgers.

To gain a better understanding of the customer preferences, he surveyed everyone involved in the operation, from the customers to the employees. He even called his suppliers in to get their opinions. He called his employees in and showed them how to properly grill the burgers. He called his supplier in to discuss alternatives to the current beef he uses. Finally, managers take action. Management may make changes.

Deming tweaked a few things to speed up the process by placing more people on the line. Customers received their burgers on time and they were tasty, too!

Juran's Approach to Quality Planning,:

Joseph Juran shared a connection with Deming. Juran's approach to quality control. While Japan was price competitive with the rest of the world, the quality of product did not measure up.

Like Deming, Juran stressed the value of total quality management. However, they summed it up by advice and consent of total quality management begins at the top of an organization and works its way down. They developed ten steps to improvement the quality .

Crosby's Ideology of Conformance to Quality Standards:

Philip B.Crosby was a contemporary leader in Total quality management. He did not implement engineering principles or steps. They simply made Total quality management easier for the layman to implement by breaking it down to an perceivable ideology that organizations should adopt.

Crosby re defined quality to mean conformity to standards set by the industry or organization that must align with customer needs.

1.7.1 Deming’s contributions:

Deming's 14 Points on Route to Quality:

1. Create constancy of purpose towards raise of product and service with the aim to become competitive and to stay in business and to provide jobs.

2. Adopt the new philosophy We are in a new economic age. Western management should awaken to the challenge, should be learn their responsibilities and take on leadership for change.

3. Cease dependence on inspection to achieve quality. Eliminate the require for inspection on a mass basis by building quality into the product in the 1st place.

4. End the practice of awarding business on the basis of price tag Instead, reduce total cost. Move towards a single supplier for any one item, on a long term relationship of loyalty and trust.

5. Institute training on the job.

6. Improve constantly and forever the system of production and service, to increase quality and productivity and thus constantly decrease costs.

7. Drive out fear, so that everyone may work effectively for the company.

8. Eliminate slogans, exhortations and targets for the work force which ask for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, The bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.

9. Break down barriers between departments. People in research, design, sales and production must work as a team to foresee problems of production and in use that may be encountered with the product or service.

10. Eliminate work standards on the factory floor. Substitute leadership.

11. Eliminate management by objectives. Eliminate management by numbers, numerical goals, substitute leadership.

12. Remove barriers to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality. Remove barriers which rob people in management and in engineering of their right to pride of workmanship. This means, for ex:, abolishment of annual or merit rating and of management by objectives.

13. Put everybody in the company to work to accomplish the transformation. The transformation is everyone's job.

14. Institute a vigorous program of education and self-improvement.

15. Institute leadership. The aim of supervision must be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul as well as supervision of production works.

1.7.2 Juran's contribution:

Juran divides quality management into three parts. They are:

1) Quality planning

2) Quality control

3) Quality improvement

(1) Quality Planning:

A self explanatory planning road map is shown below:

Quality planning road map

Quality Control:

At this stage, control processes are designed to ensure the quality goals set in the planning to:

- Establish standards of performance
- Note the difference between actual performance and standards
- Measure actual performance
- Choose units of measurements
- Choose control subjects
- Take the action to close the performance gap.

Quality Improvement:

At this stage, there are ten steps to quality improvement.

1) Build awareness of the need and opportunity

2) Set goals for improvement

3) Organize to reach the goals

4) Provide training

5) Carry out projects to solve problems

6) Report progress

7) Give recognition

8) Communicate results

9) Keep score

10) Maintain momentum by making annual improvement.

1.7.3 Crosby's contribution:

The four absolutes of quality observed by Crosby are

1. Performance,

2. Reliability,

3. Features,

4. Conformance.

One of Crosby's main contributions to quality was a set of four absolutes of quality management that provides insight into his quality philosophy.

1. **Quality has to be defined as conformance to requirements, not as goodness**. Management must establish requirements, supply the wherewithal and encourage and help employees to get the job done. The basis of this policy is "Do it right the first time".

2. **The performance standard must be zero defects, not "good enough."** The only performance standard that makes sense for "do it right the first time" is zero defects. Zero defects needs to be a performance standard for everyone in the company, from top management to workers on the line.

3. **The system for assuring quality is prevention, not appraisal**. The first step to defect and error prevention is to understand the process by that a product is produced. Once a defect occurs, discovery and elimination are top priorities. Prevention is a knowledge issue for quality-focused workers.

4. **The measurement of quality is the price of non conformance, not indices.** A dollar figure can be established for the cost of quality by determining the difference between the price of non-conformance and the price of conformance.

The price of non-conformance is the expense of doing things the wrong way and can account for 20 to 35 percentage of revenues. Price of conformance is the cost of doing things right typically 3 to 4 percentage. Managers should spend time identifying where cost of quality is occurring and address what makes it occur.

1.8 Barriers to TQM

Let us discuss the barriers to TQM implementation and solution.

The various barriers in implementing Total quality Management are:

1) Lack of management commitment.

2) Lack of faith in and support to Total quality management activities among management personnel.

3) Failure to appreciate Total quality management as a cultural revolution. In other words the inability to change the organizational culture.

4) Misunderstanding about the concept of Total quality management.

5) Improper planning.

6) Lack of effective communication.

7) Lack of employees commitment.

8) Lack of continuous training and education.

9) Lack of interest or incompetence of leaders.

10) Non-application of proper tools and techniques.

11) Ineffective measurement techniques and lack of access to data and results.

12) Inadequate use of empowerment and team work.

13) Inadequate attention to internal and external customers.

14) Delay or non-implementation of quality improvement team's recommendations.

1.9 Quality statements

Three element of quality statements are:

1. Vision statement

2. Mission statement

3. Quality policy statement

1. Vision Statement: A short declaration of what an organization aspires to be tomorrow. It describes aspirations for the future without specifying the means that will be used to achieve those desired ends.

2. Mission Statement: Usually one paragraph, which describes the finite on of the organization. It provides a clear statement of purpose for employees, customers and suppliers.

Key Elements:

• Obligation to stakeholders

• Scope of the business

• Sources of competitive advantage

• View of the future

3. Quality Policy Statement: It is a guide for everyone in the organization as how they provide products and service to the customers. It is used as a guide to management action. It should be written by the CEO with feedback.

1.10 Customer focus

When we outline Total Quality Management, the term quality implies the customer and the product or service being delivered to the same. Here, we would attempt to understand the definition of a business enterprise in terms of its customers, it serves within the marketplace.

In alternative a company's business is outlined by what needs it is trying to satisfy, by which customer group it is targeting and by the technologies it will use and the functions it will perform in serving target market.

One of the foremost important factors for the success of an enterprise is its customers. Without them, a business cannot exist however to capture customers, a business must try to find out what people want, how much and how often they will buy and how their post-purchase satisfaction are ensured.

Customer focus

Relation of a method vs its customer:

The process is outlined as a set of interconnected activities that results in a product or a service to be offered to a customer. Thus, their relation is of critical importance. The result of one activity directly affects the opposite entity (the customer).

For example, all the client complaints are unit analogous to method variation. If variation that is non-conformance to the quality standards occurs, it will ultimately affect the quality of the end product or service. Therefore, it is important to keep a strong check on this aspect.

1.11 Customer orientation

A customer oriented organization places customer satisfaction at the core of each of its business decisions. Customer orientation is defined as an approach to sales and customer relations in which staff focus on helping customers to meet their long-term needs and wants.

Customer orientation is of ultimate importance to deliver value added products. There are four basic stages for customer orientation.

They are,

1) Develop:

Development has to be done keeping customer needs into mind.

Products should be customer oriented.

The development cycle time should be minimal.

2) Manufacture:

As per the product, the manufacturing should be such that it gives the best products to the customer.

Quality must not be compromised.

Manufacturing cycle time should be reduced.

3) Market:

Identifying and targeting the right customer.

Customization of the products for the market.

Processing the demand as early as possible.

4) Deliver:

Deliver to the target customer.

Value for money products.

Reduce delivery time.

1.12 Customer satisfaction

Customer satisfaction is not an objective statistics, but more of a feeling or attitude. If a customer is happy with a product or a service, it has hired or purchase they will pay their bills promptly, which greatly improves cash flow-the lifeblood of any organization.

The Customer is the King - Emphasized by Today's Buyer's Market. TQM's Purpose is meeting or exceeding customer expectations, so that the customers are delighted. The customer satisfactions must be the primary goal of any organization.

Customer satisfaction

CUSTOMER SATISFACTION MODEL

The customers are

- Not dependent on the organization, but the organization depends on them.
- Doing a favor when they seek business and not vice-versa.
- The most important people in the business.
- A part of business, not outsiders and they are life blood of the business.
- Not an interruption to work, but are the purpose of it.
- Deserve the most courteous and attentive treatment.
- People who come with their needs and jobs.

Customer satisfaction:

The company should exceed the customer expectations and make him delighted. This means giving the customers more than Total quality management aims at satisfying customers requirements that never remain constant but keep on changing with the change in times environment,

circumstances, needs fashion standard of living etc. Customers satisfaction has several dimension such as :

1. Suitability.

2. Reliability.

3. Durability the life aspect of quality.

4. Maintainability.

5. Aesthetic look.

6. Safe and foolproof workability.

7. Good packaging.

8. Versatility.

9. Variety in products and services .

10. Customers information and training demonstration/consulting.

11. Speed of service.

12. After sales service and support to customer.

13. Civility of service at all levels.

14. Affordability.

15. Good image of the company and customers confidence in the organization based on past experience.

16. Value for money spent by customer.

Initially the organization must identify and define the customers in terms of internal/external short term/long term end users intermediate users product/ service user and their categories as industrial consumer their buying capabilities and locations.

After identifying the customers, their needs and requirements should be established and defined. The organization should then establish its quality policies, code of conduct, legislation, etc.

TYPES OF CUSTOMERS

Internal Customer: The customer inside the company are called internal customers.

External Customers: An external customer is the one who used the product or service or who purchase the products or service or who influences the sale of the product or service**.**

Let us distinguish between internal and external customers.

Internal Customer	**External Customer**
The customers inside the company is called internal customer.	The customers outside the company is called external customer.
All of them depends upon each other.	Each customer were independent of each other.
Every person is considered as a customer of the preceding operation.	Every person, who uses the product or service.
These customer satisfaction will affect only the process inside the company.	This customer satisfaction will improve the sale of the product.
These customer will not depend upon the quality of the product.	They mostly concern about the products quality.

Questionnaire to evaluate the level of customer satisfaction:

(1) Mobile Service Provider:

1) How long have we used our service?

2) How often do we use our service?

3) Please tell us why we feel that way.

4) Overall, how satisfied were we with our service?

5) Thinking of our most recent experience with our service, how much do we agree with worth of our service?

7) Thinking of similar services offered by other companies, how would we compare our service offered to them?

8) Would we recommend our service to colleagues or contacts within our industry ?

9) What do we like about our product/service?

10) What suggestions do we have to improve our service?

11) Why do we feel that way about recommending our service?

(2) A Sport Shoe Manufacturer:

1) When did we buy our product?

2) How satisfied are we with the product quality?

3) Would we buy this product again?

4) How often do we use our product?

5) Compared to other similar products on the market, do we find the value for money of this product?

6) Would we recommend this product to others we know?

7) Compared to other similar products, how do we have used our product?

8) Is there anything else that we would like to share with us that would help us to improve our product?

1.13 Customer complaints

Complaints are a natural consequence of any service activity. Mistakes are an unavoidable feature of all human endeavor and thus also of service delivery.

Service recovery is the process of putting the situation right though it has been defined more widely and more proactively as the action of seeking out and dealing with failures in the delivery of service.

The term "complaint management" is used to include service recovery and involves the receipt, settlement, investigation.

Dealing with complaints:

When the customer pays for a product or service, it is assumed that the product can work correctly or that the service received is as promised. Ideally, the customer will be satisfied and there will be no complaints.

If there is a customer complains about it, our company must quickly answer the complaint and solve the customer's problem. This is often done through our company's customer service activity. However also, we required to follow up and increase our business processes to rectify the problem.

Solve the problem:

We need to quickly answer the complaint and solve the problem. It can be to give money back, exchange a product or do some repair.

Special bonus:

To make sure the customer is completely satisfied, some companies can provide some special service or a reduced price on another product. It is done to assure the customer may come back for more business. Lot of retail stores have a generous return policy to satisfy dissatisfied customers.

Dishonest customers:

Unfortunately, there are dishonest customers they can make incorrect claims to get some bonus. Many people will utilize a product or piece of clothing and then return it, saying they were not satisfied.

High end female's clothing stores often can have expensive gowns returned after some important event. The clothes have obviously been worn, The customer told she is not satisfied or has changed her thought. commonly, the store will refund the money.

Since it is often challenging to tell if the complaint is valid or not, the company can follow the adage, "The customer is always right." But since some insincere people repeat their crimes, a better adage is "The customer is always right... once."

Price in customer service:

When a company sells a product or provides a service, part of the pricing should include the cost of servicing a certain % of defective complaints or products .

Rectify problem:

The 2nd thing a company should do upon receiving a complaint is to seek to rectify the problem.

Though a company hopes not to get complaints, they often can be blessing in disguise. Sometimes problems can be caught and fixed before they cause serious negative feedback or even legal problems.

It is in the company's best interest to solve any problems and try to made sure that they don't happen again. It is silly for a company not to be use the customer complaints to initiate a corrective action.

Not dealing with complaints:

Businesses that don't bother about satisfying their customers usually get more customer complaints. Answering them can of course, cost the company money. Many companies will try to mollify angry customers but many do not even bother.

Making money off complaints :

One software company holds weekly staff meetings to build morale and allow for status reports from eaither department. One part of their meetings is the report on how many customer problems they rectified the past week. In cause the number increased, the group was given praise.

When asked why they praise increased problem calls, as opposed to working to fix those problems in the software or documentation, the owner said which they charge for each call, so it is a way to increase their income.

In other words, instead of making the customer completely satisfied with the product, they preferred some dissatisfaction, so who could fix the problem and make lot of money from it.

This software package was a high ticket, expensive application that was mainly sold to small companies. They also charged $50 for a user manual for the software.

Since the customers make a substantial investment in the software, they wanted to continue using it. However I wonder how much ill-will was created, even if the application usually performed well.

Complaints that fall on deaf ears:

Have we ever experienced poor service or purchased a defective product and complained about it, only to have our complaints fall on deaf ears?. Most of companies which have plenty of business feel they do not required to bother with complainers.

These businesses become very independent, especially if they have a product or service in demand. Some continue to succeed, even though they ignore customer complaints, however many will pay the price of lost business and degraded reputation in the long run.

Apology mollifies customer:

A company which responds and apologizes mollifies the complaining customer. But many of these companies do not rectify the problem, such as the hotel in the above the concept. The act of responding to the customer and apologizing is fine business. Not fixing the problem is risky, though it may backfire on the company.

Satisfied customer:

1st of all, it will help to satisfy the customer, so we will get repeat business or referrals. In fact, in some cases, effectively dealing with a customer complaint may lead to a more loyal customer than others who might not complain or have problems.

Can rectify problems:

Another benefit of dealing with complaints is that we can see weaknesses in our process or products that may be rectified. This can prevent possible future complaints or problems down the line. It is an effective form of customer feedback, although one we hope to eliminate.

Major concern about complaints:

For every formal complaint we receive, there may be ten other customers who were dissatisfied and who felt like complaining, however who never did. Instead, they change brands and tell their friends of the dissatisfaction.

It is said that an unhappy customer can tell 13 people about his or her dissatisfaction. That is not that the type of word of mouth advertising we want. The company goal should be to get no complaints at all.

1.14 Customer retention

Customer retention is the activity that a selling organization undertakes in order to reduce customer defections. Successful customer retention starts with the first contact an organization has with a customer and continues throughout the entire lifetime of a relationship.

Customer retention is the process of retaining the existing customers. The various tools used are:

1. Comment card

2. Customer questionnaire

3. Focus groups

4. Toll-free telephone numbers

5. Report cards

6. Internet and computer etc

Importance of customer retention:

1. Number of complaints received per month.

2. Increase in sales value.

3. Increase in profit.

4. Number of Warrants used.

1.15 Costs of quality

As defined by Philip B. Crosby in his book "Quality Is Free", the cost of quality has two main components:

1. The cost of good quality and

2. The cost of poor quality.

As Figure shows:

1. The cost of poor quality affects internal and external costs resulting from failing to meet requirements.

2. The cost of good quality affects costs for investing in the prevention of non-conformance to requirements. Costs for appraising a product or service for conformance to requirements.

Costs of quality

Types of Quality Cost:

1. Prevention cost

2. Appraisal cost

3. Internal failure cost

4. External failure cost

1. Prevention Cost: The costs that occur when a company is performing activities designed to prevent quality problems from arising in product or services.

Prevention cost includes:

• Cost of quality planning

• Cost of documenting

• Process control cost

• Cost of training

• Cost associated with preventing recurring defects

2. Appraisal Cost: The cost associated with measuring, evaluating a auditing products or services to ensure that they conform to specifications or requirements. Appraisal costs relate to testing, execution and examination to assess whether specified quality is being maintained.

3. Cost of Internal Failure: They arise due to internal failures. There costs are linked to correcting mistakes before delivering of the products such as scrap, rework, reinspection, retesting and sales discounts for inferior products.

4. Cost of External Failure: They arise from the rejection of the products, services by the customers due to poor quality. These costs are associated with the adjustment of malfunctions after delivery of the product such as repair cost, travel and lodging expenses, replacement cost, stock space parts, lost goodwill of customer, guarantee and warranty costs and dispatch-ment costs.

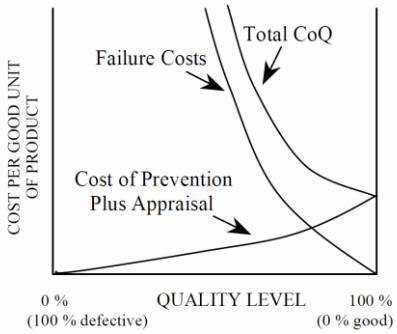
The Categories of Quality Cost: Many companies summarize quality costs into four broad categories. They are,

a) Internal failure costs - The cost associated with defects that are found prior to transfer of the product to the customer.

b) External failure costs - The cost associated with defects that are found after product is slipped to the customer.

c) Appraisal costs - The cost incurred in determining the degree of conformance to quality requirement.

d) Prevention costs - The cost incurred in keeping failure and appraisal costs to a minimum. Sometimes we can also include the hidden costs i.e., implicit costs.



Cost of Quality

The Categories of Quality Cost:

Many companies summarize the quality costs into four main categories. They are:

a) Internal failure costs - These costs are associated with defects that are found prior to transfer of the product to the customer.

b) External failure costs - These costs are associated with defects that are found after product is being shipped to the customer.

c) Appraisal costs - The cost incurred while determining the level of conformance to quality requirement.

d) Prevention costs - The cost incurred in keeping failure and appraisal costs to a minimum. Sometimes we can also include the hidden costs i.e., implicit costs.

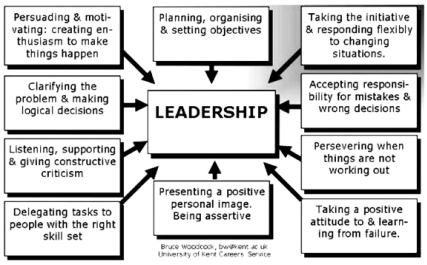
2

TQM PRINCIPLES

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

2.1 Leadership

Leadership is the process of influencing others towards the accomplishment of goals. A leader triggers the will to do, show the direction and guides the group members towards the accomplishment of goals.



CHARACTERISTICS OF QUALITY LEADERS

The important characteristics of a successful leader are:

1. Empower people.

2. Customers first.

3. Value people.

4. Build supplier partnership.

5. Strive for excellence.

6. Improve communication.

7. Demonstrate involvement/commitment.

8. Explain & deploy policy.

9. Establish system.

10. Encourage collaboration.

11. Promote teamwork.

12. Benchmark continuously.

2.2 Strategic quality planning

Strategic Planning:

A systematic process of envisioning a desired future and translating this vision into broadly defined goals and a sequence of steps to achieve them.

Seven Steps to Strategic Planning

The process starts with the principle that quality and customer satisfaction are the center of organization future. It brings together all the buy stakeholders.

1. Customer Needs

The 1st step is to discover the future needs of the customers. What will they want? How will the organization meet and exceed expectations?

2. Customer Positioning

Next the planners determine where the organizations want to be in relation to the customers. They want to do retain, expand or reduce the customer base? Service or product with low quality performance should be targeted for eliminated or break . The organization needs to concentrate its efforts on area of excellence.

3. **Gap Analysis**

This step needed the planners to identify the gaps between the current state and the future state of the organization. An analysis of the core values and concepts is an excellent technique for pinpointing gaps.

4. Predict the Future

Next, the planners should look into their crystal balls to predict future conditions that will affect their product or service. Demographics, economic forecasts and technical assessments or projections are tools that help predict the future. Above one organization, product or service has become obsolete because if failed to foresee the changing technology. Note that the rate of change is continually increasing.

5. Closing the Gap

The plan can now be developed to close the gap by establishing goals and responsibilities. All stakeholders must be included in the development of the plan.

6. Alignment

As the plan is developed, it must be aligned with the mission, vision and core values and concepts alignment, the plan will have little chance of success.

7. Implementation

This last step is frequently the most difficult. Resources must be allocated to collecting data, designing changes and overcoming resistance to change. Also part of this step is the monitoring activity to ensure that progress is being made.

The planning group must be meet at least once a year to assess progress and take any corrective action. Strategic planning may be performed by any organization. It will be highly effective, allowing organizations to do the right thing at the right time.

2.3 Quality Councils

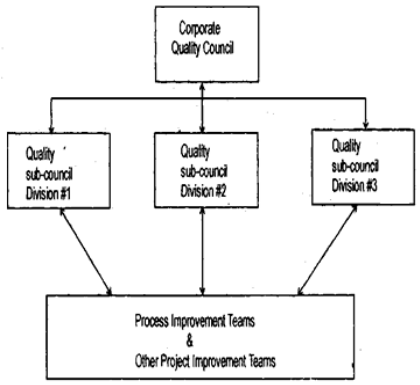
Quality council is structured in

1) University Academic Department

2) Manufacturing Facility

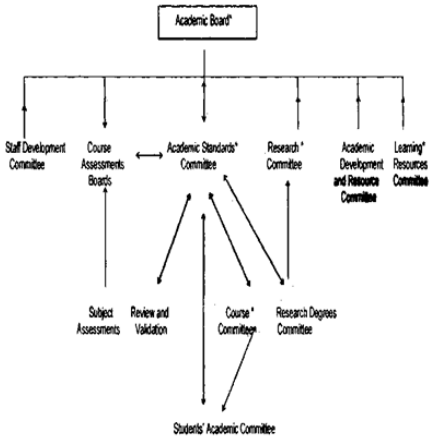
(1) University Academic Departments

The following figure shows that a typical quality structure . Academic quality assurance committees involving different level of cross sectional participation by committees.



Quality councils in University academic department

(2) Manufacturing Facility



Quality councils in Manufacturing Facility

This is the quality structure involved in manufacturing facility that involves different levels of cross sectional participation by managers.

2.4 Employee involvement

The main reason of employee involvement in the success of business. The shrinking global market has led to stiff competition in the business and industrial arena. The entry of a number of new companies in both local and global into multi markets has given the customer a wide array of product choices.

Lot of these new companies are able to produce the similar or same products at almost the same or minimum costs. Thus, customers today have a wide range of products to choose from. These products are never only meet their specifications closely, however also their inexpensive. Competition has extended far beyond the manufacturing or private sector. Today, the service, government and non-profit sectors also face stiff competition.

The required to grow and succeed in an increasingly competitive market has seen the implementation of various quality initiatives in different organizations. Issues solving and process improvements are two vital aspects of the quality initiatives and proactive actions are being taken to prevent problems.

Total Quality Management is a continuous process that strives to increase customer satisfaction, lower costs and minimize defects and variations in every aspect and every process of the business. Total quality management involves a number of catchwords such as Just-In-Time, quality circles, employee involvement, continuous process improvement, empowerment, Kaizen, self-directed work groups and world-class quality.

Generally, the philosophy of Total quality management is to involve every employee in the organization along with its suppliers and distributors to improve product quality and enhance customer satisfaction. One of the important concepts of Total quality management is employee involvement. That is a relatively new method, which is a contrast to conventional management practices, where in management takes all decisions and workers just follow them to accomplish their jobs.

This top down management style is very slow and inflexible with small room for competition. Survival in today's time starved, customer driven market requires rapid response times from manufacturers and other businesses to the ever changing customer needs. This focuses on the importance of employee involvement in any total quality management initiative. Workers involvement is a system where in employees are encouraged to use their expertise and knowledge to suggest methods for improvements in their work areas.

These suggestions could pertain to improvements in the job, the product, the work atmosphere or the company as a whole. Lot of companies have ventured into a participative style of management by involving employees in the problem solving and decision making processes.

Once Ford faced continuous threat of competition from Japanese car manufacturers, it ventured to study how the Japanese were excelling in their performance efficiency. It established a target force to study the Japanese manufacturing process. Results showed that the key to Japanese performance and efficiency was their empowered teamwork and the workforce involved. Workers were given the responsibility and authority to stop a process, if the quality failed to meet the standards specified.

Most of the successful companies are those, which have achieved a close relationship between workers and the managers. The policies in these companies fostered teamwork, participation, continuous learning and flexibility. the change from conventional management practices to the new style was not achieved overnight. Learning and implementing participative management requires a

lot of effort and time. Implementation of workers involvement systems required to many changes in the existing company practices.

The five obstacles that arise when companies try to shift from a traditional management style to a participative one are listed following:

• Resistance to change.

• Lack of participative skills among Workers.

• Mistrust of the management's motives by the workers.

• Lack of executive commitment.

• Lack of clear expectations from the workers.

While change of any kind is difficult for the employees, when suddenly asked for inputs, they tend to doubt the motives of the management. Similarly, they are unsure of the extent of inputs required and the importance placed by the management on these inputs.

Low experience in participative activities is a hindrance. Above the all, it is vital for the management to remain continuously committed to the cause of Total quality management and employee involvement.

Benefits of Employee Involvement:

•it meets the organizational goals and objectives.

•it improves the quality.

• It improves the productivity.

• It improves the team activities.

2.5 Motivation

Over the evolution of total quality management, the emphasis upon people has increased. Any organization has to produce it's output through its people. so, the key to quality performance is the organization's ability to motivate its people towards desired actions and behaviors and rais their level of quality consciousness.

Motivation is related on emotions. It is the find for positive emotional experiences and the avoidance of negative emotional experiences. Motivation is involved in the performance of all learned responses. It is a behavior that can not occur unless it is triggered. In general, psychologists question whether motivation is a primary or secondary influence on behavior. All are has a certain

needs and goals. To obtain the goals and meet the needs that a person needs, they will have to agree to do work and provide services in exchange for what they need. One key to making those agreements satisfactory is how fair they are being treated.

People want to ensure that they will be consistently treated fairly. Perceived factors of being treated fairly from an employee perspective are salary, bonus, benefits, incentives if any and etc.

Salary and benefits are not only a seen as motivation, but as entitlement for the work that is being Complete. If the agreement is seen as being unfair, the person may be dissatisfied which will result in lowest morale. However if the agreement is seen as being fair, it will play a role in whether the person is a "motivated" employee.

A company's learning environment can impact the motivation of an employee. Highly motivated employees possess high performance, a desire to learn, high input, innovate and grow with a company as long as the company provides desirable outcomes. In turn, the company will have seasoned staff that is skilled and motivated to advance the company through innovation and customer retention.

The 1st step in a company's plan to create a learning environment is realizing the value of employees and how they want and need, to be motivated.

Motivation

Motivation Techniques:

1. Management by Objective (MBO) and goal setting:

Management by Objective (MBO) is a process of collaborative goal-setting between a manager and a subordinate with the understanding that the degree of goal attainment by the subordinate will be a major factor in evaluating and rewarding the subordinate's performance. When the manager sits with the subordinates, jointly established aim/goal for them and agree that the future rewards will

be based on aim attainment then he/she is expected to be more motivated to work toward the aim that merit them.

Motivation Techniques

2. Participation in management:

Sub ordinates are likely to be motivated the most when they are not only consulted but are also allowed to participate in decision-making. In fact the right kind of participation yields each motivation and knowledge valuable for enterprise success. Participation appeals to the required for affiliation and acceptance. It is a means of recognition and thus enhances subordinates eagerness to work harder.

3. Monetary Incentives:

Money cann't be a overlooked as a motivator. It can also mean power or status.

money is can used for order as a motivator, a manager has to remember the following:

• An enterprise can make its wages and salaries competitive within their industry and their geographic area to attract and hold people.

• People usually calculate their compensation in the light of what their equals are receiving.

• Money may motivate only when the prospective payment is large relative to a person's income.

• Unless bonuses for mangers are based to a major extent on individual performance, an enterprise is not buying much motivation with them. In so far as possible, compensation has to be based on performance.

4. Modified work week/flexible working hours:

There is considerable interest among employees in altering the work week to suit their convenience best. The primary motivational implications of the modified work week are that modification in

their routine helps them satisfy their higher-level needs and provides them with an opportunity to fulfill several of their needs simultaneously.

By allowing employee more independence in terms of when they come to work and when they leave, mangers acknowledge and show “esteem” for the employees’ ability to exercise self control. It is hoped that employees will respond with higher levels of motivation.

Modified workweeks give employees the opportunity to fulfill a variety of needs. Using flexible working hours, a person can contribute to the organization and still have time, for example, to study for the MBA programmed for executives or to carry on business as a part-time occupation.

5. Quality of working life:

This is an important motivational technique, use by managers in western societies. Quality of working life is not only a very broad approach to job enrichment but also an interdisciplinary field of inquiry and action combining industrial relations, industrial engineering, industrial sociology and psychology , organization theory and development, motivation and leadership theory,etc.

Mangers have regarded Quality of working life as a promising means of dealing with stagnation productivity. Workers and trade union leaders have also seen it as a way to improve working conditions and productivity and also as a means of justifying higher pay. It will also help minimizing labor disputes and ensuring industrial democracy.

6. Effective criticism:

This can be a springboard for improving an employee’s behavior and performance. Adopting a positive approach makes criticism less difficult as well as more effective. The manager must examine his or her own motives before criticizing. The manager must be plan the presentation of his criticism in the best possible form with a view to motivating rather than rebuking him or her Criticism should apply to the use of personal efforts for improvement now, not later. Specific time schedules for improvements are also to be set up.

7. Job enrichment:

Making jobs challenging and meaningful is an accepted way of motivating employees greatly. In job enrichment, the attempt is to build into jobs a higher sense of challenge and achievement. Jobs may be enriched by variety. But they also may be enriched by

Giving workers more freedom at workplace:

Giving subordinates a feeling of personal responsibility for their tasks.Encouraging participation of workers and interaction between them.Giving subordinates feedback on their job performance.

Involving workers in the analysis and change of physical aspects of the work environment, such as cleanliness, layout temperature, lighting, etc.

Several studies tend to prove that workers will work harder if their jobs are enriched and expanded so as to give them greater control over their work and more freedom from their supervisor.

Job enrichment has certain limitations also. Cost factor, very often, comes to hinder job enrichment. Jobs requiring hi-tech specialization, special machinery and technology may also suffer from being too meaningful to workers.

It merits mention that the limitations of job enrichment apply mainly to jobs requiring low skill levels. The jobs of managers, professionals or technicians already contain varying degrees of challenge and accomplishment.

2.6 Empowerment

Employee involvement

The important concepts of Total quality management is employee involvement. It is contrast to conventional quality assurance management practices, here management takes all decisions and workers just follow them to accomplish their jobs.

Employee empowerment

In addition to employee involvement, employee empowerment is another management concept – the basic theme of which is to give employees the means for making important decisions and making those decisions the "right" ones. When done right, the results are heightened productivity and a better quality of work life.

Where as the actual practice of employee empowerment varies across organizations, empowerment is based on the fundamental concepts of job job enrichment and enlargement. Job enlargement involves changing the scope of the work to include a greater portion of the horizontal process. Job enrichment involves increasing the depth of the job to include responsibilities that have traditionally been carried out at higher levels of the organization.

Benefits of Employee Involvement and Empowerment:

While each employee involvement and employee empowerment are each distinct practices and are usually mutually exclusive to one another, the benefits of each can be similar. The main benefits of employee involvement and empowerment are enhanced morale, lot of productivity, healthier coworker relationships and creative thinking.

1. Improved Morale:

Involving employees in decisions and policy changes that directly affect their jobs while also empowering workers to be more autonomous, greatly increase company morale at large. When employees are treated as an asset and their input is given consideration, confidence improve

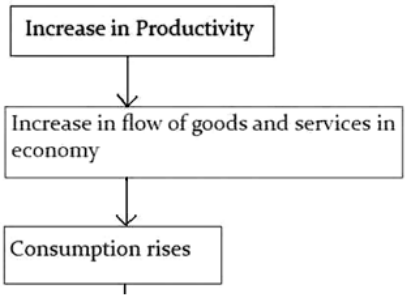
among every team member and the organization sees significant gains in different facets like productivity and loyalty.

Increased morale may also improve employee longevity with the company, as the longer an workers is associated with the company, the long experienced they become. This makes them mentors to new employees and therefore indispensable to managerial staff.

2. Increased Productivity:

Both employee empowerment in quality management quality management practices also translate into raised productivity. Employees with an investment in the best interest of the organization increase their role in the company and foster a stronger work ethic.

When employees are given independence and focused to be more self-sufficient, they eventually become more efficient as they learn to navigate their responsibilities with minimal interference or/and relying less on managerial staff for direction. This allows managerial staff more time to tend to their own responsibilities other than giving assignments to subordinates and decreases micromanagement, that minimizes productivity.



Increased Productivity

3. **Team Cohesion:**

Employee empowerment fosters better relationships between employees and with their managers, as employees that are given more independence tend to form good working relationships. Both sees the other as mutually benefiting from their working relationship.

In addition, lot of self governance in the work place lessens dependence on supervisors, managers and redirects that reliance laterally to coworkers.

4. Innovation:

Employee empowerment cultivates innovation, as employees which have a stake in company growth and sustainability may offer more ideas and problem solving solutions when obstacles arise.

The employee meets particular challenges or finds improvements in policies, products or procedures, it may foster growth and more critical and imaginative thinking. Employees will offer different perspectives than a managers and be able to offer a creative solution not otherwise considered by staff.

2.7 Team and Teamwork

Characteristics of successful Teams:

1. Team Charter - Document defines the mission and union.

2. Clear Objectives - Team should be stated clearly.

3. Accountability - Team performance is accountable.

4. Training - in problem solving technique.

5. Cohesiveness - Members should be comfortable working with each other.

6. Well-defined decision procedure - Right decision in right time.

7. Ground Rules - Separate ruler of operation and conduct.

8. Open Communication - Everyone feels to speak in the team.

9. Balanced Participation - Team involvement is necessary.

3. Team Composition - Size should not be more than ten members.

10. Sponsor - To provide support to the organization.

11. Resource - Adequate information must be given.

11. Trust - Trust among the members and management.

12. Appropriate Leadership - Leadership to motivate and guide the team.

13. Effective Problem Solving - It can be achieved using problem solving methods.

Barriers to Team's program.

The barriers to a team’s program are

• Insufficient training

• Lack of management support

• Lack of planning

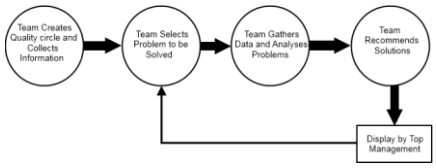
• Project scope too large

• Incompatible rewards and compensation

2.8 Quality circles

It is a participatory management technique that enlists the help of employees in solving problems related to their own jobs. Circles are formed of employees working together in an operation who meet at intervals to discuss problems of quality and solutions for improvements.

Quality circles (QC)



Quality circles

An organization may identify 4-5 different areas which require continuous monitoring and improvement. Each area may be allocated to a group (form from members of the organization) which is called Quality Circle 1, 2, 3 etc, depending on the number of areas identified.

The Quality Circles should have a common objective of working for the success of their project in the area being allocated to them. These areas may be called Kaizen activities. Membership of each QC is on a voluntary basis.

The following are suggested steps in forming a Quality Circle:

• Divide the staff into small groups - Quality Circles.

• All QCs to meet twice a year to present progress of Kaizen activities.

• Discuss & analyze problems identified in each area by QCs.

• Recommend possible solutions by QCs.

• Explain the concept and the advantages of Kaizen activities.

• Prepare implementation plans.

• Inform staff of the Kaizen activities.

• Reward QC with the best effort in achieving their objectives.

• Write a proposal in implementing plans.

Recognition is a process whereby management shows acknowledgment of an employee outstanding performance. Recognition is a form of employee positive motivation. Recognition of employees is highly essential as people find themselves in a accepted and winning role. To sustain employee's interest and to propel them towards continuous improvement, it is essential to recognize the people. This acknowledgment may be of financial, psychological or both in nature.

Reward is a tangible one, such as increase salaries, commissions, cash bonus, gain sharing, *etc.*, to promote desirable behavior.

The employee's effort towards the improvement should be recognized for many reasons. Recognition is essential to:

• Show the company's appreciation for better performance.

• Reinforce behavioral patterns.

• Stimulate creative efforts.

• Improve employee's morale.

• Create satisfied workplace.

Types of Rewards: Broadly, one can classify the rewarding systems into two groups. They are

1. Intrinsic Rewards: These are related to feelings of accomplishment or self-worth.

2. Extrinsic Rewards: These are related to pay or compensation issues.

Richard S. Allen and Ralph H. Kilmann have tabulated the different intrinsic and extrinsic rewards in Table.

Intrinsic Rewards	**Extrinsic Rewards**
1. Non-monetary forms of recognition to acknowledge the achievement of quality improvement goals.	**1.** Profit sharing.
2. Celebrations to acknowledge the achievement of quality improvement goals.	**2.** Gain sharing.
3. Regular expressions of appreciation by managers and leaders to employees to acknowledge the achievement of quality improvement goals.	**3.** Employment security.

4. 360° performance appraisals-feedback from co-workers (other than the immediate supervisor), subordinates or customers is incorporated into performance appraisals.	**4.** Compensation time.
5. Formal suggestion system available for individuals to make quality improvement suggestions.	**5.** Individual based performance systems.
6. Development based performance appraisals.	**6.** Quality based performance appraisals.

2.9 Performance appraisal

The various steps that are involved in performance appraisal are

• Communicate performance expectations to employees.

• Discuss the appraisal with the employee.

• Measure actual performance.

• Compare actual performance with standards.

• If necessary, initiate correction action.

• Establish performance standards.

Performance evaluation is often used as a tool to determine salary adjustment as well as an opportunity to improve job performance. When inappropriately applied, performance evaluations may be perceived as being unfair, wasteful and demeaning.

In some organizations, there has been a trend to break down job functions to their most detailed level, weight each activity, judge it and then add up all the invalid numbers to achieve a more invalid judgment of a person's performance.

This non Gestalt evaluation is an inspection philosophy that has not served manufacturing or health care very effectively.

Over the past four years, we have evolved a performance evaluation process at Minneapolis Childers's Medical Center for physicians in both patient care and management roles.

2.10 Continuous process improvement- PDCA cycle, 5S, Kaizen

Continuous process improvement has the following approaches:

• Juran Trilogy

• PDCA Cycle

• 5002H Method

• 5S House Keeping

• Kaizen

Concept of Continuous Process Improvement:

Continuous improvement is based on a Japanese Concept known as Kaizen, that is the philosophy of frequently seeking ways to improve operations. It involves identifying benchmarks of excellent practices and instilling a sense of employee ownership of the process. The main target can be on:

• Reducing the length of time needed to process requests for loans in bank.

• The amount of scrap generated at a milling machine or the number of employee injuries.

Continuous improvement will also focus on problems with customers or suppliers like customers who request frequent changes in shipping quantities and suppliers that to maintain high quality.

The bases of the continuous improvement philosophy are the beliefs that virtually any aspect of an operation can be improved and which the people most closely associated with an operation are in the best position to identify the changes that should be made. Consequently, employee involvement plays a big role in continuous improvement programs.

Getting Started with Continuous Improvement

Instilling a philosophy of continuous improvement in an organization could be a lengthy process and several steps are essential to its eventual success.

• Train employees in the methods of statistical process control (SPC) and different tools for improvement quality.

• Make SPC methods a normal aspect of daily operations.

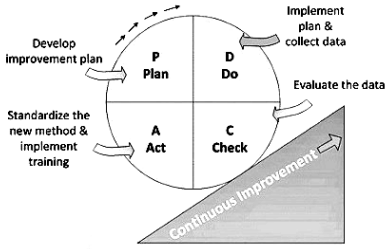
• Build work teams and employee involvement.

• Utilize problem-solving techniques in teamworks.

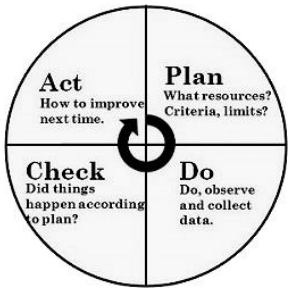
• Develop a sense of operator ownership of the process.

Employee involvement is central to the philosophy of continuous improvement. But, the last two steps are crucial if the philosophy is to be the part of everyday operations. A sense of operator ownership emerges when employees feel as if they own the processes and methods, they use and take pride in the quality of product or service they produce.

It comes from participation on teamworks and in problem solving activities, that instill in employees a feeling that they have some control over their workplace.



2.10.1 PDCA cycle



PDCA cycle

PLAN - What is needed?

DO - it

CHECK - That it works

ACT - To correct problems.

1. Plan:

• Generate possible solutions.

• Define the problem.

• Collect and analyze the process data.

• Define the performance indicators.

2. Do:

• Train all involved employees in the use of quality improvement methods and techniques.

• Implement the plan on a limited scale or conduct an experiment to the test of the proposed improvement.

3. Check:

• Evaluate the trial project with the performance indicators.

• Verify whether the improvement has been successful or not.

4. Act:

• Usually the cycle will be repeated under the different circumstances.

• Act to implement proven improvements.

• The improvements are documented in standard procedures.

2.10.2 5S

The concept of 5S:

5S Philosophy focuses on effective work place organization and standardized work procedures. 5S simplifies our work environment, reduces waste and non-value activity whereas improving quality efficiency and safety.

Sort: (Seiri) it is focuses on eliminating unnecessary items from the workplace.

Set In Order: (Seiten) is the 2nd of the 5S and focuses on efficient and effective storage methods.

Shine: (Seiso) Once we have eliminated the clutter and junk that has been clogging our work areas and identified and located the necessary items, the next step are to thoroughly clean the work area.

Standardize: (Seiketsu) Once the 1st three 5S's have been implemented, we should concentrate on standardizing best practice in our work area.

Sustain: (Shitsuke) this is by far the most difficult S to implement and achieve. Once fully implemented, the 5S process may increase morale, create positive impressions on customers and increase efficiency and organization.

Benefits of 5S:

• Work place becomes clean and better organized.

• Results in good company image.

• Shop flux and office operations become easier.

• People become disciplined.

• Better quality awareness.

• Contribute to productivity quality.

2.10.3 Kaizen

Kaizen: It is the process of continuous improvement in small increments make the process more efficient, effective, controllable and adequate.

• It requires recognition of effort before results.

• It involves everybody in the company.

• It is achieved through convention know how and PDCA.

• It is employee oriented.

• It requires little investment but great effort to maintain.

Two activities of Kaizen:

1. Maintenance – involves activities directed at maintaining current technological, managerial and operating standards.

2. Improvement – aims at revising the current standards.

Three Basic Principles of Kaizen:

1. Work place effectiveness –Tool box includes the 5S for improving workplace effectiveness.

2. Elimination of waste, discrepancy and strain - 3MUs in Japanese word;

MURI- Strain

MURA- Discrepancy

MUDA – Waste

3. Standardization – in terms of processes,machinery and materials .

Goals of Kaizen:

1. Kaizen is implemented not for profit but for quality.

2. The success of kaizen must be measurable through its impact on the customer satisfaction.

3. If it is process oriented when Kaizen can be successful

Kaizen is a low cost approach to improvement, available to every organization that has the determination to increase its delighting customers or customer. Kaizen brings out improvements, its results to improve the productivity, efficiency, profitability and above the all better quality of life of employees and satisfied customers.

Two ways for Kaizen Implementation:

1. Gradual Improvement of processes.

2. Kaizen Blitz – quick improvement methodology on the contrary. A dramatic fashion of improvement which usually completed in a single week. Its goal is simply to create better production line.

2.11 Supplier partnership

A commitment to continuous quality improvement do not be translated into reality without treating supplier as partner.

Principles of customer / supplier relation

•The customer and the supplier are responsible for the control quality.

• The customer is responsible for to providing the supplier with sufficient requirements so that the supplier will know precisely what to do.

• Both the customer and the supplier must be independent of each other and respect each others independence.

• Both the customer and the supplier must enter into an non adversarial contract with respect to quality, quantity, price, delivery method and terms of payments.

• Both the customer and the supplier must decide the methods to evaluate the quality of the product or service to the satisfaction of both parties.

• The supplier is responsible for providing the quality that can satisfy the customer and submitting necessary data upon the customer's request.

• Both the customer and the supplier must establish in the contract the method by that they will reach an amicable settlement of any disputes that may arise.

• Both the customer and the supplier should perform business activities like procurement, inventory planning, production, clerical work and system so which an amicable and satisfactory relationship is maintained.

• Both the customer and the supplier must continually exchange information, sometimes using multi-functional teams, in order to improve the product or service quality.

• When dealing with business transactions, both the customer and the supplier should always have the best interest of the end user in mind.

2.12 Partnering

It is defined as a continuing relationship between a buying firm and supplying firm involving a commitment over an extended time period, an exchange of information and acknowledgment of the risks and rewards of the relationship.

Benefits of supplier partnering

• Reduced cost.

• Increased Productivity.

• Improved Quality.

• Increased market share.

• Increased opportunity for innovation.

• Increased efficiency.

• Continuous improvement of products/services.

2.13 Supplier selection

• **Multiple sourcing** - For a single item having two or more supplier, resulting in better quality, better service at lower cost

• **Sole sourcing** - Only one supplier for the entire organization. This may be forced to happen because of patent, technical specification, raw material location and monopolistic supplier.

• **Single sourcing** - Use of one supplier to one item when several sources are available leading to long-term partnering relationship.

BASIS OF SUPPLIER SELECTION

1. Strategic direction of supplier firm.

2. Quality,

3. Reliability,

4. Compatibility,

5. Cost,

6. Delivery,

7. Management,

8. Goal congruence.

2.14 Supplier Rating

Additionally referred as score card system, it is used to obtain an overall rating of supplier performance based on quality, price, performance and production capability.

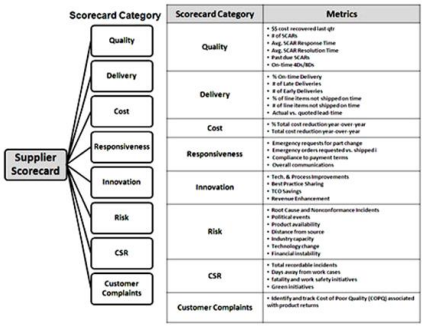
Objectives of supplier rating

• Obtain an overall rating of supplier performance.

• Provide each supplier about the details of problems for right action.

• Maintain and improve the partnering relationship between the customer and the supplier.

• Ensure effective communication with suppliers.



Supplier rating

3

TQM TOOLS AND TECHNIQUES I

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

3.1 The seven traditional tools of quality

The 7 tools are:

• Check sheet

• Scatter diagram

• Control chart

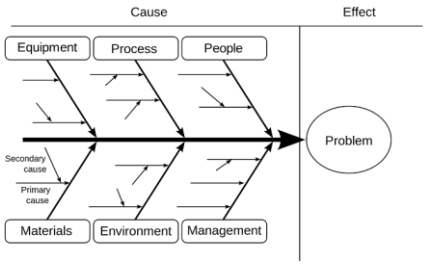
• Cause and effect diagram

• Pareto chart

• Histogram

• Stratification (alternately, run chart or flow chart)

Cause and effect diagram (fishbone chart): Identifies many possible causes for an effect or problem and sorts ideas into useful categories.



Cause and Effect diagram

Check sheet:

A structured, prepared form for analyzing and collecting of data, a generic tool that can be adapted for a wide variety of purposes.

The types of check sheets that are commonly used are

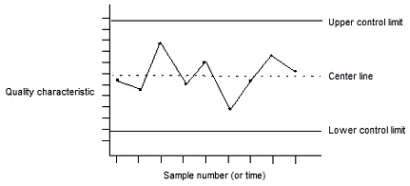
• Deflective item check sheet.

• Deflect location check sheet.

• Process distribution check sheet.

• Deflect factor check sheet.

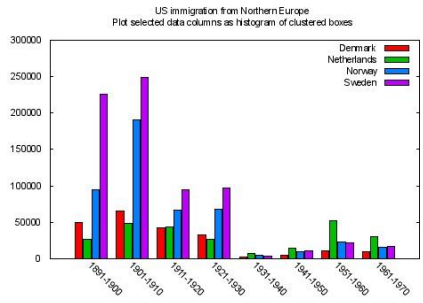
Control charts: Graphs used to study how a process changes over time.



Control chart

Histograms

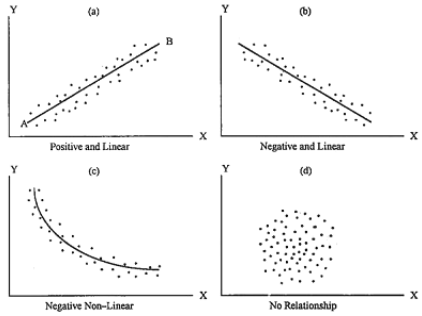
To illustrate and examine various data element in order to make decisions regarding them Effective when comparing statistical, survey or questionnaire results.



Histogram

Scatter Diagram

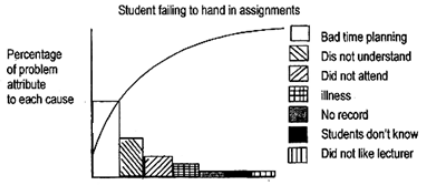
A scatter graph/diagram is a tool for analyzing relationships between two variables. One variable is plotted on the horizontal axis and the other is plotted on the vertical axis. The pattern of their intersecting points can graphically show relationship patterns.



Scatter diagram

Pareto chart:

A Pareto chart is a special form of a bar graph and is used to display the relative importance of



Pareto Chart

Applications of Pareto Chart:

a. Focusing on critical issues by ranking them in terms of importance and frequency.

b. Prioritizing problems or causes to efficiently initiate problem solving (Example: which discipline problems should be tackled first? or what is the most frequent complaint by parents, regarding the school? solution of what production problem will increase quality most?)

Stratification: A technique that separates data gathered from a variety of sources so that patterns can be seen.

Run Chart follows a process over a specific period of time like accrual rates, to track high and low points in its run and ultimately identify trends, shifts and patterns.

Pareto Charts / Analysis

Rates issues according to value and frequency by prioritizing specific problems or causes in a manner that facilitates problem solving. Identify groupings of qualitative data, like most frequent

complaint, most generally purchased preservation aid, etc. in order to measure which have priority. It can be scheduled over select periods of time to track changes. They can also be created in retrospect, as a before and after analysis of a process change.

Flowcharts and Modeling Diagrams

• Assist in the definition and analysis of every step in a process by illustrating it in a clear and comprehensive manner.

• Identify areas where workflow can be blocked or diverted and where workflow is fluid.

• Identify where steps need to be removed or added to improve efficiency and create standardized workflow.

3.2 New management tools

The seven management tools are:

• Tree diagram

• Relations diagram

• Affinity diagram

• Arrow diagram

• Matrix data analyst diagram

• Matrix diagram

• Process decision programme chart Relations diagram

Definition

This tool displays all the interrelated cause-and-effect relationships and factors involved in a complex problem and describes desired outcomes. The process of creating an interrelationship diagraph helps a group analyze the natural links between different aspects of a complex situation.

Process

• Agree on the issue or question.

• Compare each element to all others. Use an "influence" arrow to connect related elements.

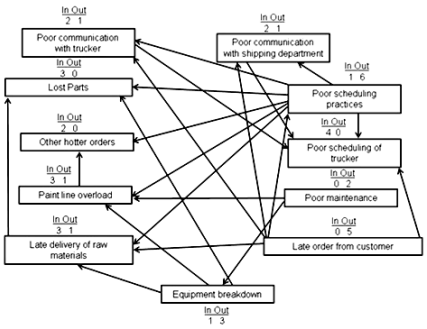
• Add a symbol to the diagram for each element involved in the issue.

• If two elements influence each other, the arrow should be drawn to reflect the stronger influence.

• The arrows must be drawn from the element that influences to the one influenced.

• Count the arrows and The elements with the most outgoing arrows will be root causes or drivers. The ones with the lot of incoming arrows will be key results or outcomes.

Example:



The inference is that Potential causes for late delivery are:

• 'Late order from customer' (five outgoing arrows).

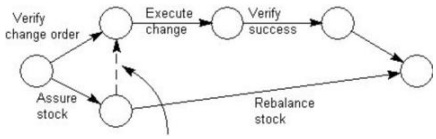
• 'Poor scheduling practices' (six outgoing arrows).

• 'Equipment breakdown' (three outgoing arrows).

Arrow diagram

For years, construction planners have used arrow diagrams to schedule and sequence project tasks. Arrow diagramming has also been taught extensively in quantitative methods, operations management and other business and engineering courses in the United States for a number of years.

Unfortunately, its use commonly has been confined to technical experts. Adding arrow diagramming to the "quality toolbox" has made it more widely available to general managers and other non-technical personnel. Figure shows an example. Time estimates can easily be added to every activity in order to schedule and control the project. Dotted line is dummy activity to ensure that execute change state only after verify change order and assume stock are completed.



Arrow Diagram

Affinity Diagram:

Purpose

The purpose of an affinity diagram is to provide a visual representation of grouping of a large number of ideas or factors or requirements into logical sets of related items to help one organize action plans in a systematic manner.

Procedure

The steps in the procedure for preparing an affinity diagram are:

1. Decide the subject or the topic.

2. Generate a large number of ideas through brainstorming.

3. Decide the number of groups and their titles. Create a card for every group. Enter the title of the group at the top of the card.

4. Arrange the cards according to the relationship between the groups.

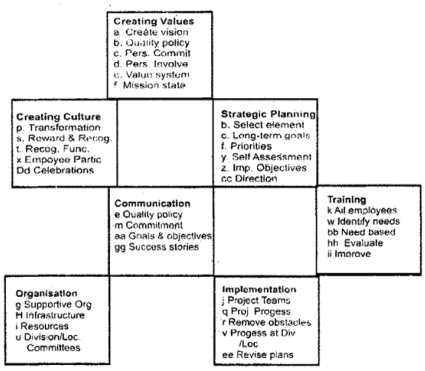
5. Distribute all the ideas among the cards. If necessary, create new cards for additional groups.

6. Give a name to the affinity diagram.

Applications

The structure and the procedure for affinity diagram would have shown how simple the tool is. Its simplicity made it easy to combine it with other tools and put it to a wide variety of applications. For instance, it can be combined with a cause and effect diagram or a relations diagram to identify and regroup causes for a problem or it will be combined with a tree diagram to categories possible solutions.

This will assist in problem solving. It can be used to group customer requirements in a complex product and can help one to design a product with characteristics and features that would satisfy and delight customers. It will be used to categories actions in an implementation plan leading to a rationalized distribution of responsibility.



Affinity Diagram

Tree Diagram:

Purpose:

The purpose of the tree diagram is to explore ways and means to achieve an objective, develop a list of alternate means to reach the desired situation in a sequential order and to present them in a visual form.

Procedure:

This tool like other tools in the 'new seven' is a group tool. A brainstorming session is necessary to collect a large number of ideas for the means to achieve the objective. The rules of brainstorming should be observed to get the best results from the tool. The steps and the procedure to develop a tree diagram is:

1. Identify a high priority problem which needs to be solved at the earliest. Prepare an objective statement describing the desired situation or the target solution.

2. Decide the appropriate form of the diagram - cascade or tree as well as direction of flow after a brief discussion. Place the target solution in the dark rectangle.

3. Brainstorm to identify the primary means to achieve the objective. Arrange them in an appropriate order keeping in mind the likely interrelations between them and place them in rectangles at the first level.

4. For every of the primary means, identify secondary means which would be necessary to attain those means. Arrange them in next level boxes.

5. Identify tertiary means required to attain each of the secondary means and place them in a proper order in the next level boxes.

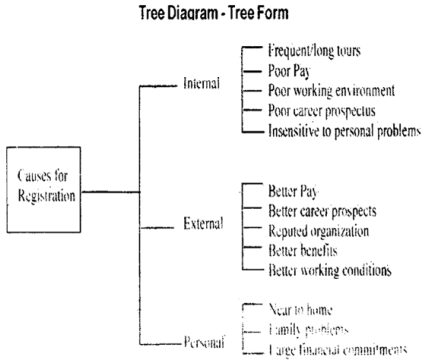
6. Continue the process till the group feels which the end of the line has been reached.

7. If a lower level means is required to attain two higher level means, it could be connected to both. Rearrange the boxes if necessary to make this possible.

8. Brainstorm to reach a consensus on the relative, importance of the last level means to priorities action.

Application:

The most important application of the tree diagram is for dividing solutions for problems. It helps one to develop a systematic step by step strategy to achieve an objective. It is also useful in monitoring the implements of solutions by taking care of accomplishment of means at various levels.

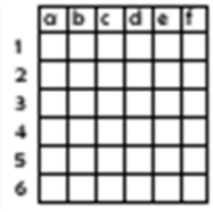


Tree Diagram

Matrix diagram

Definition:

This tool shows the relationship between items. At every intersection, a relationship is either absent or present. It then gives information about the relationship such as its strength, the roles played by different individuals or measurements. Six differently shaped matrices are possible: L, T, Y, X, C, R and roof-shaped, depending on how many groups must be compared.



Matrix Diagram

A personnel department wanted to improve social activity within the company in order to increase loyalty levels. A theory was put forwards that soft-skills training contributed significantly towards this in-house socializing. The personnel manager consequently decided to utilize a Matrix Diagram to investigate this.

The steps taken were

Objective: Investigate effect of soft-skills training on social activity.

Matrix: T-matrix, with people on main stem, in-house training courses to left, attendance of social clubs to right, plus an extra column for years of service.

Comparison: In-house training - tick for attendance within last three years; social clubs - three bands corresponding to under 30%, 30% to 70% and over 70% attendance in the same period.

Process decision program chart

Definition :

A useful way of planning is to break down tasks into a hierarchy, using a Tree Diagram. The PDPC extends the tree diagram a couple of levels to identify risks and countermeasures for the bottom level tasks. Different shaped boxes are used to highlight risks and identify possible countermeasures. The PDPC is similar to the Failure Modes and Effects Analysis in that both identify risks, consequences of failure and contingency actions and the FMEA also rates relative risk levels for each potential failure point.

Process:

From the bottom level of some activity box, the PDPC adds levels for:

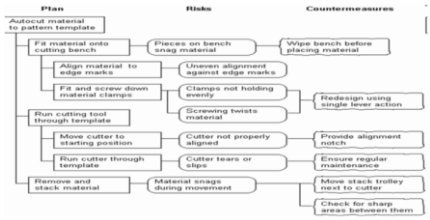
• Identifying what can go wrong

• Consequences of that failure

• Possible countermeasures

Example:

A dress production team at a clothes manufacturer was improving the cutting-out process in order to minimize material wastage. They decided to utilize PDPC on the work breakdown structure to identify potential problems and ways of avoiding them.



As a result of this, the cutting was tested on cheaper material, resulting in the material clamp being redesigned to prevent drag, a start notch provided for the cutter and the general area being inspected for sharp corners to minimize snag problems. The cutting operator was involved in the PDPC process and the subsequent tests, resulting in her fully understanding the process. The final cutting process thereafter ran very smoothly with very little error.

Matrix Data Analysis diagram

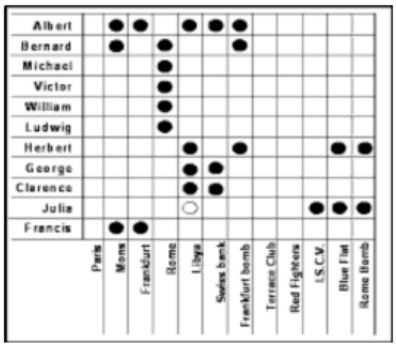
Matrix data analysis gives data and arranges them to display quantitative relationships among variables to made them more easily understood and analyzed. In its original form used in Japan, matrix data analysis is a rigorous, statistically based “factor analysis” technique.

Many feel that this method, while worthwhile for many applications, is too quantitative to be used on a daily basis and have developed alternative tools that are easier to understand and implement. Some of those alternatives are similar to decision analysis matrices that we may have studied in a quantitative methods course.

A small example of matrix data analysis is shown in Figure. In this example, MicroTech market researchers determined that the four most important consumer requirements are price, reliability, delivery and technical support. Through market research, an importance weighting was developed for each.

They also determined numerical ratings for the company and their best competitor. Such an analysis provides information as to that actions the company should deploy to better meet key customer requirements.

For example, in the below Figure, reliability is the highest in importance and Micro Tech has a narrow lead over its best competitor. Thus, they should continue to strive for improving product reliability. Also, technical support is of relatively high importance, however Micro Tech is perceived to be inferior to its best competitor in this category. Thus, improving the quality of support services should be a major objective.



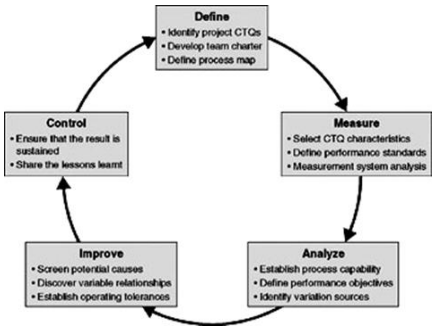
Matrix Data Analysis Diagram

3.3 Six sigma: Concepts, Methodology, Applications to manufacturing, service sector including IT

Six-sigma: Concepts, methodology:

Six sigma concept is a set of activities, an organization uses to win and retain customer's satisfaction. It can be provided either before, during or after the sale of the product.

Six sigma is described by acronym DMAIC. In DMAIC,



Six-sigma

1. Define:

Define is the first step of DMAIC, The definition step identifies activities and quality tools.

Define Activities:

• Identify project, champion and project owner

• Determine customer requirements and critical to quality (CTQs)

• Define problem, objective, goals and benefits

• Define stakeholder/resource analysis

• Develop project plan

Define quality tools:

• Project charter and plans

• Effort/impact analysis

• Process mapping

• Tree diagram

2. Measure:

It enables the benchmarking of process using actual data and quantify it.

Measure Activities:

• Define project scope

• Select output characteristic (Y's)

• Determine project critical Xs and Ys

• Assess performance specification

• Validate measurement systems

• Establish initial capability (Y's)

• Determine process capability.

Measure Quality tools:

• Quality function deployment-QFD

• Measurement system analysis-MSA

• Check sheet

3. Analyze:

It's necessary to analyze the process applying statistical tools.

Analyze activities:

• Define performance objectives

• Analyze sources of variability

• Determine root causes using data

Analyzing quality tools:

• Statistical analysis of data

• Cause and effect or event diagram

• Histogram

• Pareto diagram

• Run chart

• Scatter diagram.

4. Improve:

Improve activities:

• Develop solution alternatives

• Screen potential causes

• Identify appropriate operating conditions

• Implement solution

• Determine solution effectiveness using data

Improve quality tools:

• Design of experiments-DOE

• Brain storming

• Failure Mode Effect Analysis

5. Control: Success is the control step depends on previous steps. Tools are put in place to process improvement gains are maintained.

Control activities:

• Determine process capability (X's)

• Realize benefits of implementing solution

• Finish the project and communicate results

Control quality tools:

• Statistical process control, SPC

• Out of control action plan, OCAP

• Design changes for the defects to be eliminated

Capability Maturing Model:

Capability maturity Model (CMM) is a collection of instruction organization can follow with the purpose to gain better control over its software development process.

The CMM ranks software development organizations in a hierarchy of five levels each with a progressively greater capability of producing quality software. Each level is described as a level of maturity. Those 5 levels are equipped with different number of instruction to follow.

Level 1-Initial :

At maturity level-one processes are usually ad hoc and the organization usually does not provide a stable environment

Level 2-Repeatable:

At this maturity level-two, software development victor are repeatable. The organization may use some basic project management to track cost and schedule.

Level 3-Defined:

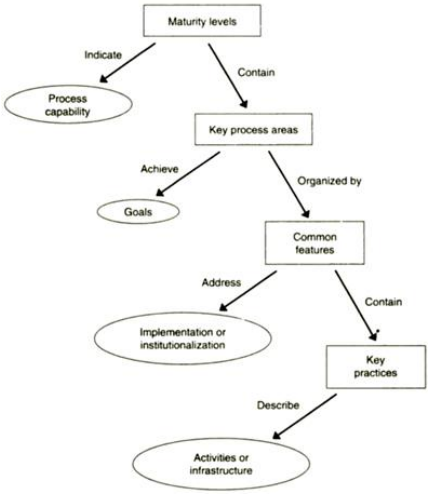
A maturity level-three, processes are well characterized and understood and are described in standards procedure, tools and methods.

Level 4-Managed:

Using precise measurement, management can effectively control the software development effort. In particular, management can identify ways to adjust and adopt the process to particular projects without measurable losses of quality or deviations from specifications.

Level5-Optimizing:

This maturity level focuses on continually improving process performance through both incremental and innovative technological improvement.



Optimizing

3.3.1 Applications to manufacturing, service sector including IT

Manufacturing industries:

The manufacturing industry is where Six Sigma has been start. so, it might seem quite obvious that there are a slew of practical applications for Six Sigma Training within the industry.

This is often taken for granted, though leaving lot of companies to assume that it will just work for them, when in reality, the need for the process needs to be established just as it would be in any other industry before it can be used.

The goal of Six Sigma Projects, as we know, is to create a plan that results in a solution to improve a process or product to a ratio of 3.4 defects per million.

For the sake of example: consider the situation. we have a process that involves creating parts for a toy and a process that automates the construction of that toy once the parts are completed.

Currently, the time consumption is astronomical and we know that there has to be a better way to produce parts and complete toys in a manner that is more effective and productive. we are not sure of what the solution is, but we know that if we take time to examine our current data and figure out what our goals are, we can determine a process that achieves our goals.

This is the perfect setup for a Six Sigma Process to become involved in within the manufacturing industry, because it can prove to be very useful.

IT industries:

DMAIC (control, define, improve, analyze, measure) is applied the same way in the information technology services sector as it was in manufacturing. Some of the challenges facing Six Sigma in the IT sector are:

• Lack of knowledge in a knowledge-based industry

• Failure to properly use DMAIC(control, define, improve, analyze, measure) in a software development project

• Data oriented tools

• Lengthy projects

• Six-Sigma as a Project Based Approach

Historically Six Sigma has been termed a project based approach to improvements. Each project, however, could take between five weeks and six months. In the information technology services sector, the length of the project is often too long to realize the benefits.

Projects are completed, resources are re-aligned and team members are transferred to other teams or sent to on site assignments. These changes affect the cohesiveness of improvement teams. Many Six Sigma projects are either delayed or canceled due to lack of participation.

3.4 Bench marking - Reason to bench mark, Bench marking process

Bench marking:

A measurement of the quality of an organization's products, policies, programs, strategies, etc. and their comparison with standard measurements / similar measurements of its peers.

It is a systematic method by which organization can measure themselves against the best industry practices.

Example:

Comparing a new product with standard product available in market.

Benchmarking Process

Benchmarking Process usually involves the following steps:

They are,

1. Identify a critical process usually that needs improvement, Example: order entry, distribution, service after sale.

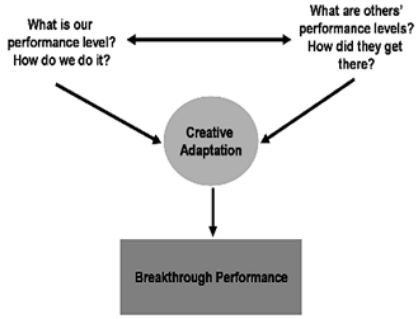
2. Identify an organization that excels in the process, preferably the best.

3. Analyze the data.

4. Contact the benchmark organization, study the benchmarking activity and visit.

5. Improve the critical process at our own organization.

6. Identify an organization that excels in the process, preferably the best.



Bench marking

Classification Based on the Organizations against whom one is Benchmarking:

1. Internal Benchmarking:

Internal Benchmarking is refers to comparison of performance between departments, plants, subsidiaries, *etc.* within the organization.

2. Industry Benchmarking:

It refers to comparison of performance by the organizations producing the same class of products and services.

3. Competitive Benchmarking:

It refers to comparison of performance against direct competitors.

4. Best in class Benchmarking:

Best in class Benchmarking is refers to comparison of performance with best practices prevalent in an organization irrespective of products.

3.4.1 Reason to bench mark

Objectives of Benchmarking

•its aims at a goal setting process to facilitate comparison with the best.

• Motivating stimulating employees for the goal of continuous quality improvement.

• Aims at external orientation of the organization.

• Identifying a technological break-through.

• Aims at searching for industry training.

3.4.2 Bench marking process

Benchmarking Process

Steps in Benchmarking Process:

Table: Step in benchmarking process

Phases	Steps	
Planning	1.	Earmark what is to be benchmarked?
	2.	Identify the best competitor.
	3.	Determine data collector method and start collecting data.
Analysis	4.	Determine current performance 'GAP'.
	5.	Project the future performance levels.
Integration	6.	Communicate the benchmark findings and gain acceptance.
	7.	Establish the functional goals. Establish functional goals. Communicate data for analysis Give acceptance for analysis
Action	8.	Develop the action plans.

	9.	Implement specific actions and monitor the progress.
	10.	Recalibrate the benchmarks.
Maturity	11.	Attain leadership position.
	12.	Integrate practices into process.

Phase I: Planning

The planning phase involves these steps:

To identify

(i) What is to be benchmarked?

(ii) To whom or what shall we compare?

(iii) How will the data be collected?

Step 1: What can be benchmarked ?

Benchmarking can be applied to any business or production process. During this step, determine which functions, tasks, processes or activities within the own organization will be subjected to benchmarking. Appoint a benchmarking team that will pilot the activity within the organization.

In this stage, formulate the project goals; determine the data to be collected and prepare a tentative list of questions.

Step 2: To whom or what shall we compare ?

Identify the world-class or leading edge companies that have a similar product or process. Important criteria for the selection of benchmark partners are : The partners should be outstanding regarding the benchmark subject, competitiveness of activities and availability of reliable information about the partners.

Step 3: Determine data collection method and collect data

• Gather both qualitative and quantitative data about the process performances of partners based on interviews, surveys and consultation of contacts and technical magazines.

• Examine the process and underlying working methods of partners.

Phase II: Analysis

The analysis phase involves a careful understanding of current process practices as well as those of benchmarking partners. This phase consists of the following two steps:

Step 4: Determine the current performance gap

Determine the gap between the performance level of the organization and that of its benchmark partner. After the data is gathered, measured and analyzed, compare these to the data of the own organization. Based on this, determine the current performance gap between the own organization and that of the benchmark partners.

Document the differences in underlying working methods and the causes of the differences in performance.

Step 5: Project future performance levels

The gap is a projection of performance. Therefore, the performance will change as industry practices change. So keeping the future in mind, project the performance levels.

Phase III: Integration

Integration is the process of using benchmark findings to get operational targets for change. It involves careful planning to incorporate new practices in the operation and ensures that benchmarking findings are incorporated in all formal planning process. This phase consists of the following two steps:

Step 6: Communicate benchmark findings and gain acceptance

• Demonstrate the benchmark findings to the management for their acceptance.

• Communicate the benchmark findings to all organizational levels to obtain support, commitment and ownership.

Step 7: **Establish functional goals**. On the base of communicated data and acceptance of analysis, functional goals will be established.

Phase IV: Action

This consists of 3 steps.

Step 8: Developing action plans.

Step 9: Implementing specifies actions and monitor the progress.

Step 10: Recalibrate benchmarks.

Phase V: Maternity

This will be reached when best industry practices are incorporated in business processes. It consists of two steps:

Step 11: Attain the leadership position.

Step 12: Integrate practices into the process.

Benchmarking is based on learning from others, rather than developing new and improved approaches. It also leads to stagnation of idea strategies best industry practices, etc.

Balance scorecard:

It is a management system that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and result. When full deployed, the balance scorecard transforms the strategic planning from an academic exercise into the nerve center of the enterprise.

3.5 FMEA - Stages, Types

Failure mode and effect analysis is also known as risk analysis. It is a preventive measure to systematically display the causes, effects and possible actions regarding observed failure. The objective of Failure mode and effect analysis is to anticipate failures and prevent them from occurring. Failure mode and effect analysis prioritizes failures and attempts to eliminate their causes.

Failure mode and effect analysis is a technique to identify and eliminate potential failures, problems, errors which occur in the system, design, process and service before they reach the customer.

3.5.1 Stages of FMEA

1. Specifying possibilities

- Prevention/Detection
- Functions
- Effects
- Possible failure modes
- Root causes

2. Quantifying risk

• Risk priority number

• Severity of effect

• Probability of cause

• Effectiveness of control to prevent cause

3. Correcting high risk causes

• Prioritizing work

• Detailed action

• Assigning action responsibility

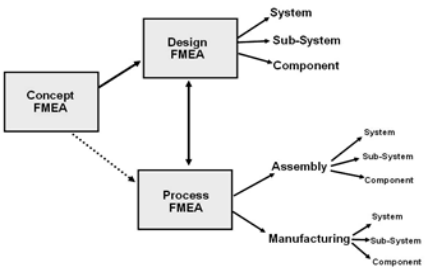
4. Check points on completion

• Revaluation of risk

• Recalculation of risk priority number

3.5.2 Types

Although the purpose, terminology and other details can vary according to type (Example: Process FMEA - PFMEA, Design FMEA - DFMEA, System FMEA, Product FMEA, FMECA, etc.), the basic methodology is similar for all.



Types of FMEA

There are several different types of Failure mode and effect analysis. Even though what is being analyzed is slightly different and the assessment criteria may change some, the step-by-step approach or technique still remains essentially the same. Some of the more common types of Failure mode and effect analysis / FMECA are described below.

Concept FMEA

• The Concept Failure mode and effect analysis is used to analyze concepts in the early stages before hardware is defined.

• It focuses on potential failure modes associated with the proposed functions of a concept proposal

• This type of Failure mode and effect analysis includes the interaction of multiple systems and interaction between the elements of a system at the concept stages.

Design FMEA

• The Design Failure mode and effect analysis is used to analyze products before they are released to production.

• It focuses on potential failure modes of products caused by design deficiencies.

• Design Failure mode and effect analysiss are normally done at three levels system, subsystem and component levels

• This type of Failure mode and effect analysis is used to analyze hardware, functions or a combination

Process FMEA

• The Process Failure mode and effect analysis is normally used to analyze manufacturing and assembly processes at the system, subsystem or component levels.

• This type of Failure mode and effect analysis focuses on potential failure modes of the process that are caused by manufacturing or assembly process deficiencies.

• Although Design Failure mode and effect analysis's are used to analyze medical equipment, Process Failure mode and effect analysis is commonly used in regard to patient care, especially associated with certain types of surgery.

• This approach is also commonly used in many industries to access certain processes involved in providing customer care.

Advantages of FMEA:

i. Risk index/RPN enables prioritization of faults

ii. Explicitly documents modes of control/ mitigation

iii. Format useful for tracking action items

iv. Easily constructed using hand-written spreadsheets or computer-based software tools

Disadvantages of FMEA:

i. Failure and reliability rates are particularly difficult to estimate when human performance is involved; which could be considered as the major disadvantage.

ii. Difficult to assess combination of event/complex interactions.

iii. Severity and occurrence ratings are often difficult for individuals or teams to estimate. Much time can be spent in discussion.

4

TQM TOOLS AND TECHNIQUES II

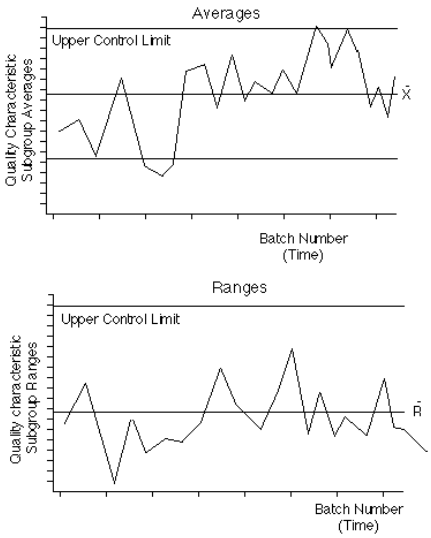
Capability - Concepts of Six Sigma - Quality Function Development (QFD) -Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

4.1 Control Charts

Control charts are a method of Statistical Process Control SPC. They enable the control of distribution of variation rather than attempting to control every individual variation.

Upper and lower control and tolerance limits are calculated for a process and sampled measures are regularly plotted about a central line between the two sets of limits. The plotted line corresponds to the stability/trend of the process.

Action can be taken based on trend rather than on individual variation. This prevents over-correction or compensation for random variation, which would lead to many rejects.



Control charts

4.2 Process Capability

The process capability is a measurable property of a process to the specification, expressed as a process capability index or as a process performance index. The output of this measurement is usually illustrated by a histogram and calculations that predict how many parts may be produced out of specification.

2 parts of process capability are,

1) Compare that variability with a proposed specification/product tolerance.

2) Measure the variability of the output of a process.

4.3 Concepts of Six sigma

Six Sigma Problem Solving Method

• **Define** - Improvement opportunity with an emphasis on increasing customer satisfaction.

• **Measure** - Determine process capability.

• **Analyze** - Identify few process input variables that affect key product output variables.

• **Improve** - Make changes to process settings, redesign processes, etc. to reduce the number of defects of key output variables.

• **Control** - Implement process control plans, standardize processes to maintain levels, install real time process monitoring tools.

4.4 Quality Function Development (QFD)

House of Quality: The primary planning tool use of QFD in house of quality are it covers the voice of the customer into product design characteristics Uses a series matrix diagram, also known as quality tables that resembles connected houses.

The Steps in building a House of Quality are:

1. List Customer Requirements-WHAT's.

2. List Technical Descriptors-HOW's.

3. Develop a Relationship Matrix between WHAT's and HOW's.

4. Develop an Inter-relationship Matrix between HOW's.

5. Competitive Assessments.

6. Customer Competitive Assessments.

7. Technical Competitive Assessments.

8. Develop Prioritized Customer Requirements.

9. Develop Prioritized Technical Descriptors.

Step 1: Customer Requirements - Voice of the Customer

The first step in a Quality Function Development project is to find what market segments will be analyzed during the process and to identify who the customers are. The team then gathers info from customers on the needs they have for the product or service.

In order to evaluate and organize this data, the team uses simple quality tools like Tree Diagrams.

Step 2: Regulatory Requirements

Not all product or service requirements are known to the customer, so the team should document requirements that are dictated by management or regulatory standards that the product must adhere to.

Step 3: Customer Importance Ratings

On a scale from 1-5, customers then rate the importance of each requirements. This number may be used later in the relationship matrix.

Step 4: Customer Rating of the Competition

Understanding how customers rate the competition can be a tremendous competitive advantage. In this step of the QFD process, it is also a good idea to ask customers how our product or service rates in relation to the competition.

There is remodeling that can take place in this part of the House of Quality. Additional rooms that identify sales opportunities, goals for continuous improvement, customer complaints, etc., can be added.

Step 5: Technical Descriptors - "Voice of the Engineer".

The technical descriptors are attributes about the product or service that can be measured and benchmarked against the competition. Technical descriptors may exist that our organization is

already using a determine product specification, however new measurements can be created to ensure that our product is meeting customer needs.

Step 6: Direction of Improvement

As the team defines the technical descriptors, a determination must be made as to the direction of movement for each descriptor.

Step 7: Relationship Matrix

The relationship matrix is where the team determines the relationship between customer needs and the company's ability to meet those requirements.

The team asks the question, "What is the strength of the relationship between the technical descriptors and the customer's needs?" Relationships can either be weak, moderate or strong or carry a numeric value of 1, 3 or 9.

Step 8: Organizational Difficulty

Rate the design attributes in terms of organizational difficulty. It is very possible that many attributes are in direct conflict. Increasing the number of sizes can be in conflict with the company's stock holding policies.

Step 9: Technical Analysis of Competitor Products

To better observe the competition, engineering then conducts a comparison of competitor technical descriptors. This process involves reverse engineering competitor products to determine specific values for competitor technical descriptors.

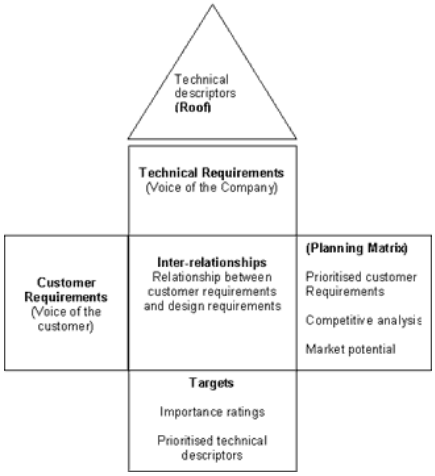
Step 10: Target Values for Technical Descriptors

At this stage in the process, the Quality Function Development team begins to establish target values for each technical descriptor. Target values shows "how much" for the technical descriptors and can then act as a base line to compare against.

Step 11: Correlation Matrix

This room in the matrix is where the term House of Quality comes from because it makes the matrix look. The correlation matrix is probably the least used room in the House of Quality.

However, this room is a help to the design engineers in the next phase of a comprehensive Quality Function Development project. Team members should examine has each of the technical descriptors impact each other. The team should document strong negative relationships between technical descriptors and work to eliminate physical contradictions.



House of quality

Devise a Quality Function Development methodology for design and development of cups used in vending machine for dispersing hot and cold beverages.

Step 1: List customer requirements - WHATs.

- Light weight.
- To be recyclable.
- To disperse hot beverages.
- To disperse cold beverages.
- Strength.
- To be safe and Eco-friendly.
- Durable.

Step 2: List technical descriptors - HOWs.

- Plastic cup.
- Plastic coated paper cup.
- Low cost materials.
- No sharp edges.
- Paper cup.

• Chemical free.

• Colorful.

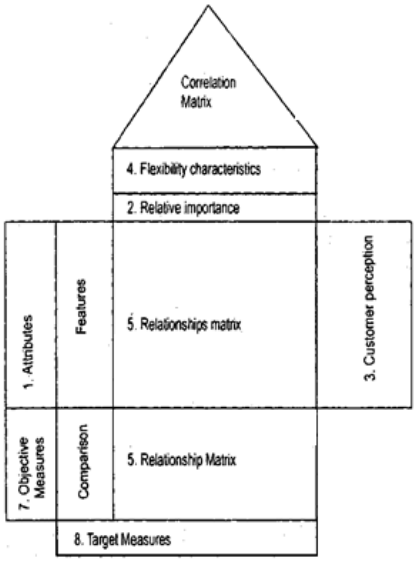
Step 3: Develop a Relationship Matrix between WHATs and HOWs by assigning scores.

Step 4: Develop an inter-relationship matrix between how.

Step 5: Competitive assessments.

Step 6: Develop prioritized customer requirements.

Step 7: Develop prioritized technical descriptors.



House of quality

Benefits of Quality Function Development:

The various benefits of quality function deployment are:

1) Improves Customer Satisfaction

• Prioritizes resources.

• Identifies items that can be acted upon.

• Creates focus on customer requirements.

• Uses competitive information effectively.

2) Reduces Implementation lime

• Limits post introduction problems.

• Decreases midstream design changes.

• Avoids future development redundancies.

3) Promotes Team Work

• Creates communication.

• Based on consensus.

• Identifies actions.

4) Provides Documentation

• Adds structure to the information.

• Documents rationale for design.

• Adapts to changes.

4.5 Taguchi quality loss function

Taguchi's Approach vs. Traditional Approach: Consider two products and one is within the specified limits and the other is just outside of the specified limits. In the traditional approach, the product within the limits is considered as a good product, while the outside one is considered as bad product.

Taguchi disagrees with this traditional approach. He believes that when a product moves from its target value, that move causes a loss no matter if the move falls inside or outside the specified limits.

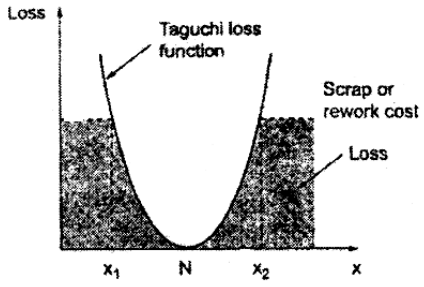
Taguchi Method:

Illustration: Suppose the manufacturing specifications for a widget is 20 ±3 mm; Under the traditional manufacturing perspective, if the widget actually produced is less than 17mm or greater than 23mm, then it must be discarded. For any widget within the 17mm to 23mm range, the traditional manufacturing perspective recognizes no quality loss cost. This traditional perspective is illustrated by the box shape in figure.

Under the Taguchi perspective, a quality loss is incurred whenever the actual widget does not reach the exact target value 20 mm. Variations from this target value will produce the quality loss cost. The area of customer dissatisfaction is illustrated by the U shape curve in figure.

Taguchi's Quadratic Quality Loss Function:

Quality loss occurs when a product's specifications deviate from target or nominal value. No matter how small the deviation, there is some loss in quality. If the deviation grows, then the loss increases. The Taguchi's U-shaped loss function curve is shown in figure.



Quadratic quality loss function

Taguchi uses a quadratic equation to determine this curve.

$L(x) = k(x - N)^2$

Where,

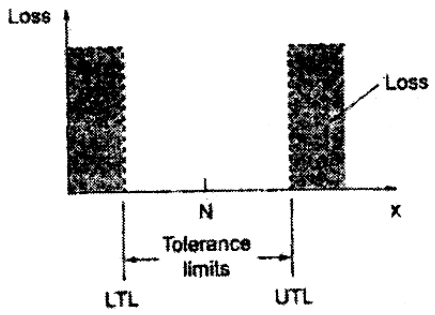
L(x) = Loss function,

k = Constant of proportionality,

x = Quality characteristic of selected product,

N= Nominal value of the chosen product and

(x - N) = Tolerance.



Loss function implicit in traditional tolerance specification

Figure shows the loss function in a traditional approach. In contrast, the smooth curve illustrates the Taguchi's approach. Cross hatching in both the figure indicates the losses.

4.6 TPM Concepts

Total productive maintenance is a system of maintaining and improving the integrity of production and quality systems through the machines, equipment, processes and employees that add business value to the organization.

TPM focuses on keeping all equipment in top working condition to avoid breakdowns and delays in the manufacturing process.

The various benefits of TPM are

• Increased equipment productivity.

• Improved equipment reliability.

• Reduced equipment downtime.

• Improved return on investment.

Objectives of TPM:

• To improve equipment effectiveness

• To achieve autonomous maintenance

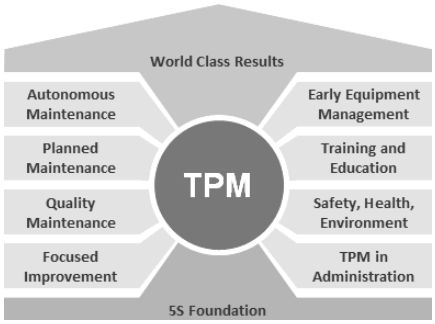
• To train all staff in relevant maintenance skills

• To plan maintenance

• To achieve early equipment management.

The traditional TPM model:

The traditional approach to TPM was developed in the 1960s and consists of 5S as a foundation and eight supporting activities.



Traditional TPM model consists of a 5S foundation

The 5S Foundation

The goal of 5S is to create a work environment that is clean and well-organized. It consists of five elements:

• Sort-eliminate anything that is not truly needed in the work area

• Set in Order-organize the remaining items

• Shine -clean and inspect the work area

• Standardize -create standards for performing the above three activities

• Sustain-ensure the standards are regularly applied

It should creates a foundation for well-running equipment. For example, in a clean and well-organized work environment, tools and parts are much easier to find and it is much easier to spot emerging issues such as fluid leaks, material spills, metal shavings from unexpected wear, hairline cracks in mechanisms, etc.

Types of maintenance:

1. Breakdown maintenance

It means that people wait until equipment fails and repair it. Such a thing may be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost.

2. Preventive maintenance

It is a daily maintenance design to retain the healthy condition of equipment and prevent failure through the prevention of deterioration, periodic inspection or equipment condition diagnosis to measure deterioration.

It is further divided into periodic maintenance and predictive maintenance. Just like human life is extended by preventive medicine, the equipment service life will be prolonged by doing preventive maintenance.

2a. Periodic maintenance (TBM):

Time based maintenance consists of periodically inspecting, servicing and cleaning equipment and replacing parts to prevent sudden failure and process problems.

2b. Predictive maintenance:

This is a method in which the service life of important part is predicted based on inspection or diagnosis, in order to use the parts to the limit of their service life.

Compared to periodic maintenance, predictive maintenance is condition based maintenance. It manages trend values by measuring and analyzing information about deterioration and employs a surveillance system, designed to monitor conditions through an on line system.

3. Corrective maintenance:

It improves equipment and its components so that preventive maintenance can be carried out reliably. Equipment with design weakness must be redesigned to improve reliability or improving maintainability.

4. Maintenance prevention:

It indicates the design of new equipment. Weakness of current machines are sufficiently studied and are incorporated before commissioning a new equipment.

4.6.1 Improvement needs of TPM

Companies that have been successful usually follow an implementation plan that includes the following 12 steps:

Step 1: Announcement of Total productivity Management (TPM). Top management needs to create an environment that will support the introduction of Total productivity Management. Without the support of management, skepticism and resistance will kill the initiative.

Step 2: Launch a formal education program. This program will inform and educate everyone in the organization about Total productivity Management (TPM) activities, benefits and the importance of contribution from everyone.

Step 3: Create an organizational support structure. This group will promote and sustain TPM activities once they begin. Team-based activities are essential to a TPM effort. This group needs to include members from every level of the organization from management to the shop floor. This structure will promote communication and will guarantee everyone is working toward the same goals.

Step 4: Establish basic Total productivity Management (TPM) policies and quantifiable goals. Analyze the existing conditions and set goals that are SMART: Specific, Measurable, Attainable, Realistic and Time-based.

Step 5: Outline a detailed master deployment plan. This plan will identify what resources will be needed and when for training, equipment restoration and improvements, maintenance management systems and new technologies.

Step 6: TPM kick-off. Implementation will begin at this stage.

Step 7: Improve the effectiveness of each piece of equipment. Project teams will analyze each piece of equipment and make the necessary improvements.

Step 8: Develop an autonomous maintenance program for operators. Operators' routine cleaning and inspection will help stabilize conditions and stop accelerated deterioration.

Step 9: Develop a planned or preventive maintenance program. Create a schedule for preventive maintenance on each piece of equipment.

Step 10: Conduct training to improve operation and maintenance skills. The maintenance department will take on the role of teachers and guides to provide training, advice and equipment information to the teams.

Step 11: Develop an early equipment management program. Apply preventive maintenance principles during the design process of equipment.

Step 12: Continuous improvement. As in any lean initiative, the organization needs to develop a continuous improvement mind set.

Maintenance and reliability as a core business strategy is key to a successful Total productivity Management (TPM) implementation. Without the support of top management, Total productivity Management (TPM) will be just another “flavor of the month.” Implementing TPM using the above 12 steps will start we on the road to “zero breakdowns” and “zero defects.”

Needs of TPM:

• Reduce cost continuously.

• Development of the best world class organization.

4.7 Performance measures

Performance measures are recognized because an important element of all Total Quality Management programs. Managers and supervisors directing the efforts of an organization or a group have a responsibility to know how, when and where to institute a wide range of changes. These changes cannot be sensibly implemented without knowledge of the appropriate information upon which they are based.

Performance measures quantitatively tell us something important about our products, services and the processes which produce them. They are a tool to help us understand, manage and improve what our organizations do. Performance measures let us know:

• If our processes are in statistical control ?

• How well we are doing ?

• If and where improvements are necessary ?

• If our customers are satisfied ?

• If we are meeting our goals ?

Most performance measures will be grouped into one of the following six general categories. However, certain organizations may develop their own categories as appropriate depending on the organization's mission:

1. **Effectiveness**: A process characteristic indicating the degree to which the process output conforms to requirements.(Are we doing the right things?)

2. **Efficiency**: A process characteristic indicating the degree to which the process produces the required output at minimum resource cost. (Are we doing things right?)

3. **Quality**: The degree to which a product or service meets customer requirements and expectations.

4. **Timeliness**: Measures whether a unit of work was done correctly and on time. Criteria should be established to define what constitutes timeliness for a given unit of work. The criterion is usually based on customer requirements.

5. **Productivity**: The value added by the process divided by the value of the labour and capital consumed.

6. **Safety**: Measures the overall health of the organization and the working environment of its employees.

QUALITY SYSTEMS

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing -QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

5.1 Need for ISO 9000

The Need for Standards

Standards are generally defined in terms of a model of best practice, against which all others may be compared. Thus, the role of standards is not to build the proverbial better mousetrap, but to ensure conformance to a standard.

The standards available for software quality management establishes the model to be employed and then the accreditation body,For Example BSIQA in the UK for the ISO9000 series, is called in to ensure that the implementation meets the required standard and indeed continues to meet the required standard over time.

In practice, three levels of accreditation are encountered, summarized in Table.

Accreditation type	**Description**
First party	Internal monitoring only
Second party	External monitoring by a customer
Third party	External monitoring by an independent standards body

It is obviously more effective to have the quality management system accredited externally. The advantage of third party accreditation over second party accreditation is that the supplier only has to satisfy one accreditor.

Clearly to have to justify one's quality practices to six different customers is undesirable, in terms of cost and time expended. In the past, certain key customers have assumed almost third party status.

It is vital that all parties understand that a standard neither improves quality directly, nor ensures perfection. It should however ensure that the correct procedures are in place and being carried out. The standard provides a model and the accreditation procedure the incentive to ensure that things are done correctly. The accreditation process provides a number of potential benefits to the supplier:

• It provides external validation to see whether the investment made in the QMS is being effective.

• It gives the supplier and their quality system external credibility.

• It allows the supplier to sell to those customers who insist on accreditation as a condition of tender.

• It qualifies the supplier to be included in buyers guides compiled by the accreditation bodies and circulated to potential customers.

The cost of accrediting a satisfactory QMS to one of the ISO 9000 series standards is small in relation to the cost of setting up the QMS in the first place. The ISO 9000 series is a generic quality management standard. The ISO 9000 series of standards are the international standards defined for quality management systems.

The three main standards are ISO 9001, 9002 and 9003. IS0 9001 is intended applications where there is a significant design element. Since most software application requires significant design input, ISO 9001 is generally the standard applied within software development.

ISO 9002 is intended for many manufacturing situations where the product is produced to a predefined specification and ISO 9003 for easy applications where the quality can be determined by a simple final inspection and testing procedure.

ISO9000 provides guidance on which standard to adopt and ISO 9004 assistance on how to establish a QMS which meets the requirements of the ISO 9000 series.

Series of Standards

i. ISO 9000, "Quality Management and Quality Assurance Standards Guidelines for Selection and Use".

ii. ISO 9001, "Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation & Servicing".

iii. ISO 9002, "Quality Systems - Model for Quality Assurance in production, Installation & Servicing".

iv. ISO 9003, "Quality Systems- Model for Quality Assurance in Final Inspection and Test".

v. ISO 9004-1, "Quality Management and Quality System Elements - Guidelines".

Elements of ISO 9000:

20 Elements of ISO 9000:

- Management Responsibility
- Contract Review
- Design Control
- Document and Data Control
- Purchasing
- Quality System
- Control of Customer Supplied Product
- Product Availability and Traceability
- Process Control
- Control of Inspection, Measuring and Test Equipment
- Inspection and Test Status
- Control of Nonconforming Product
- Corrective and Preventive Action
- Handling, Storage, Packaging, Preservation and Delivery
- Inspection and Testing
- Control of Quality Records
- Training
- Internal Quality Audits
- Servicing
- Statistical Techniques

S.no	**TITLE**	**DESCRIPTION**

1.	Scope	The purpose of the standard is for the organization to demonstrate its ability to provide a product that meets customer requirements.
2.	Normative reference	There are other standards which being listed constitute provisions of the ISO 9000 standard.
3..	Quality management system	Provides general requirements for the QMS and defines documentation requirements.
4.	Terms and conditions	To describe the supply chain supplier —> Organization —> customer.
5.	Management responsibility	Defines the requirements top managers must perform to ensure the effectiveness of the QMS.
6.	Resource Managements	Defines the requirements, companies must meet to provide adequate resources to implement and maintain the QMS and to continually improve its effectiveness.
7.	Product realization	Defines requirements for processes related to product realization.
8.	Measuring, analysis and improvement	Define requirements for maintaining, measuring analysis and improvement processes needed to demonstrate conformity of the product ensure conformity of the QMS.

5.2 ISO 9001-2008 Quality System

ISO 9001:2008 specifies requirements for a quality management system where an organization required to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements and aims to enhance customer satisfaction through the effective application of the system including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.

All requirements of this International Standard are generic and are intended to be applicable to all organizations regardless of type, size and product provided where any requirements of this International Standard cannot be applied due to the nature of an organization and its product, this can be considered for exclusion.

When exclusions are made, claims of conformity to this International Standard are not acceptable unless these exclusions are limited to requirements within clause seven and such exclusions do not affect the organization's ability or responsibility to provide product that meets customer and applicable regulatory requirements.

5.3 Documentation

The documents required by most organization are:

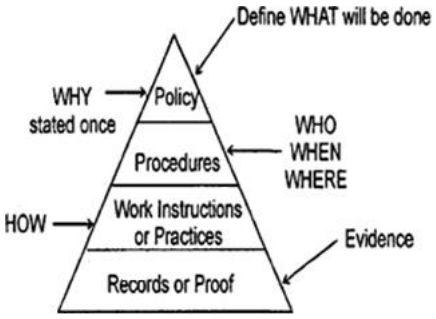
1. Quality Policy Manual

2. Quality System Procedure

3. Work Instructions

4. Record/Formats/Forms

The below system documentation can be viewed as a hierarchy containing four levels as shown in figure.



Documentation pyramid

1. Quality Policy Manual

Quality policy manual is the first level of documentation. This is the document that defines 'what will be done' and 'why'. The 'why' can be stated just once as a quality policy statement. This statement should be a short and simple definition of the organization quality intentions.

The remainder of the policy manual addresses what will be done to comply with the standard being used. The policy manual communicates the quality policy and objectives of an organization. This manual is a living document. Because it reflects the current system being followed in the organization.

2. Quality System Procedures -QSPS

The second level of documentation is the quality procedures. These procedures describe the methods that will be and to implement and perform the gated policies. These procedures define who should perform specific tasks, when the task should be done and where documentation will be made. These documents collectively define the organization's operations from receiving an enquiry to delivering a completed product or service.

The procedures are confidential documents of the organization and therefore need not be revealed to outsiders.

3. Work Instructions - WIs

This third level of documentation is generally company specific. It gives details of how individual work processes (for example, welding, machining, casting, etc.) are carded out within a company.

Work instructions should also specify how the work should be done; who should undertake the work and what records are to be maintained. The work instructions may be in the form of a detailed drawing, recipe, routing sheet specific job function, photograph, video or simply a sample for comparison of conformity. The work instructions should be written by the employee who performs the task.

4. Records/Formats/Forms

These provide evidence of activity having been performed in compliance with quality system procedure. Records may be forms that are filled-out, a stamp of approval on a product or a signature and date on some type of document. Records are used to provide trace ability of actions taken on a specific product or batch of products.

Benefits of documentation

The documentation of quality systems serves the following benefits:

1. Documentation regularizes the method of performing the day-to-day activities.

2. It provides formats for standardizing practices.

3. It provides reference for assessing degree of enforcement in practice.

4. It facilitates trouble shooting for tracing back on the processes.

5. It demonstrates the ISO quality system certification.

5.4 Quality Auditing

Quality Auditing

Quality auditing should be carried out in order to verify whether a quality system is effective and suitable.

Definition: A quality system audit is defined as "a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements, whether these arrangements are implemented effectively and whether these are suitable to achieve objectives."

Features of Quality Audits:

Some salient features about quality audits are:

• The quality audit typically applies to quality systems or elements such as processes, products or services. Such audits are often called 'quality system audits', 'process quality audits', 'product quality audits' and 'service quality audit' respectively.

• Quality audits are carried by staff who are not directly responsible in the areas being audited. But preferably auditors should work in co-operation with relevant personnel.

• Quality audit is an information gathering activity. It is not a 'policy' kind of activity.

• Quality audits may be conducted for internal or external purposes. They need not cover whole quality system at once, but may cover elements of it.

Types of Audits: The general classification of audits is given below:

(i) First party audit: This refers to an internal audit where the auditee is its own client, i.e., audit is done by an organization, working on itself.

(ii) Second party audit: This refers to audit by one organization on another organization (auditee). This type of audit is normally done on a supplier by a customer.

(iii) Third party audit: This refers to audit by an independent organization on a supplier, for accreditation assessment purposes.

Objectives of Quality Audits/Need for Quality Audits:

The objectives of quality audit programmers are:

• To determine the conformity or non-conformity of the quality system elements with regard to specified requirements.

• To meet regulatory requirements, if applicable.

• To determine the effectiveness of the implemented quality system in meeting specified quality objectives.

• To permit the listing of the audited organization's quality system in a register for third party certification.

• To evaluate an organization's own quality system against a quality system standard.

Stages of an Audit:

The four stages of the auditing are:

1. Audit planning

2. Audit performance

3. Audit reporting

4. Audit follow-up

Quality AUDIT

Quality Audits examine the elements of a quality management system in order to evaluate how well these elements comply with quality system requirements.

The objectives of the external audit:

a) Determine the actual performance conforms to the documented quality systems.

b) Follow up on noncompliance items of previous audits.

c) Provide continued improvement in the system through feedback to management.

d) Initiate corrective action activities in response to deficiencies.

e) Cause the auditee to think about the process, thereby creating possible improvements.

The objectives of the internal audit:

a) Determine the actual performance conforms to the documented quality systems.

b) Initiate corrective action activities in response to deficiencies.

c) Provide continued improvement in the system through feedback to management.

d) Follow up on noncompliance items of previous audits.

e) Cause the auditee to think about the process, thereby creating possible improvements.

Let us discuss the external and internal audits on quality.

Internal Audit	**External Audit**
• Here auditee is its own client.	Here auditee is by another organization.
• This type of audit results to improve the internal quality.	This type of audit results to improve the overall product quality.
• Here the audit may be frequent.	Here the audit may be once a twice per year.
• They are planned activity.	They may be surprised audit.
• This gives informal reports.	This gives a formal report.

5.5 QS 9000 - ISO 14000 - Concepts, Requirements and Benefits

Elements of QS 9000:

QS 9000 standards can be divided into three sections. They are:

Section 1:ISO 9000 based requirements

The section one requirements include the exact text of ISO 9001 with the addition of automotive/heavy trucking requirements.

Section 2: Automotive sector specific requirements

This section includes common requirements for all automotive supplies agreed by the 'Big three'

The sector specific requirements are:

1. Production part approval process (P-PAP)

2. Continuous improvement

3. Manufacturing capabilities.

Section 3: Customer specific requirements

This section deals with the specific requirements of each customer over and above the requirements specified in section two.

5.5.1 Requirements

Requirements of ISO 14001 are:

a) Environmental aspects,

b) Objectives and targets,

c) Legal and other requirements,

d) Environmental Management Programs.

Four elements for the checking & corrective action of ISO 14001 are:

a) Monitoring and measuring,

b) Non-conformance and corrective and preventative action,

c) Records,

d) EMS audit.

5.5.2 Benefits

Benefits of ISO 9000 Standards:

• Achievement of international standard of quality,

• Higher productivity,

• Increased profitability,

• Value for money,

• Customer satisfaction,

• Improved corporate image,

• Growth of the organization,

• Access to global market,

• Higher morale of employees.

Organizational Benefits of QS14000

• Assuming customers of a commitment to environmental management.

• Better industry/government relation.

• Meeting customer requirement.

• Market share increase.

• Improve public relation.

• Conserving input material and energy.

• Increase investor satisfaction.

• Low cost insurance, easy attainment of permits and authorization.

The major difference between ISO 9000 and QS 14000 are:

• ISO 9000 family concerned with management but quality QS 14000 family relates with environmental management.

• ISO 9000 family focuses only on management aspects in product quality whereas QS 14000 focuses only on environmental aspects and impacts of that product.

Benefits of ISO 14000

The ISO 14000 standards are practical tools for organizations who are not satisfied with mere compliance with legislation - which may be perceived as a cost of doing business. They are useful tools for proactive organizations who understand that implementing a strategic approach can bring return on investment in environment-related measures.

The systematic ISO 14001:2004 approach requires the organization to take a hard look at all areas where its activities have an environmental impact. A properly designed ISO 14001:2004 Environmental Management Systems allows efficient identification of opportunities for cost savings. It can trigger procedural and/or technological changes that reduce the total cost of a product or improve its value.

Some of the benefits of implementing an ISO 14000 Environmental Management System in accordance with the ISO 14000 standards include:

1. Operational Benefits

• Efficiency, discipline and operational integration with ISO 9000.

• Greater employee involvement in business operations with a more motivated workforce.

• Easier to obtain operational permits and authorizations.

• Safer products.

• Assists in developing and transferring technology within the company.

• Fewer operating costs.

• Savings from safer workplace conditions.

• Helps reduce pollution.

• Reduction of costs associated with emissions, discharges, waste handling, transport and disposal.

• Improvements in the product as a result of process changes.

2. Environmental Benefits

• Conserves natural resources - electricity, gas, space and water with resultant cost savings.

• Minimizes hazardous and non - hazardous waste.

• Prevents pollution and reduces wastage.

3. Marketing Benefits

• Delivers profits from marketing "green" products.

• Demonstrates to customers that the firm has met environmental expectations.

• Provides a competitive marketing tool.

• Meets potential national and international government purchasing requirements.

• Improves international competitiveness.

4. Financial Benefits

• Elimination of costs associated with conformance to conflicting national standards.

• Improved access to capital.

• Process cost savings by reduction of material and energy input.

• Shareholder criteria/Satisfying investor.

• Improves the organization's relationship with insurance companies.

• Helps reduce liability and risk.

A. Global

• Remove trade barriers and Facilitate trade.

• Improve environmental performance of planet earth.

• Build consensus that there is a need for environment management and a common terminology for EMS.

B. Organizational

• Assuring customers of a commitment to environmental management.

• Maintaining a good public/community relations image.

• Satisfying investor criteria and improving access to capital.

• Obtaining insurance at reasonable cost.

• Improving industry/Government relations.

• Meeting customer requirements.

• Reducing incidents that result in liability.

• Facilitating the attainment of permits and authorization.

• Improving defense posture in litigation.

• Conserving input materials and energy.

5.6 TQM Implementation in manufacturing and service sectors

Step 1: Top Management Commitment

• The top management should be willing to commit the resources necessary to achieve certification.

Step 2: Appoint the Management Representative

• The management representative is responsible for coordinating the implementation and maintenance of the quality system. Also he is the contact person for all parties involved in the process.

Step 3: Awareness

• The next step is to create awareness about the ISO 9000 quality management system.

• Since the implementation of the quality system requires involvement of all members in the organization, the members must understand the process and implications of ISO program.

Step 4: Appoint an Implementation Team

• Now the implementation team should be formed.

• This team must be drawn from all levels and areas of the organization.

• The team must identify the quality management system processes and their sequence and interaction.

Step 5: Training

• The implementation team, supervisors and internal audit team must be trained.

• This activity can be accomplished through in-house training programs, seminars, workshops, etc.

Step 6: Time Schedule

• This activity develops a time schedule for the implementation and registration of the system.

• This time frame may vary, depending on the size and type of organization.

Step 7: Select Element Owners

• The implementation team selects owners for each of the system elements. Many of these owners will be members of the implementation team.

• Each owner has the option of selecting a team to assist the process.

Step 8: Review the Present System

• A review of the present quality system should be performed.

• Copies of all the quality manuals, procedures, work instructions and forms presently in use are obtained.

• This activity is a gap analysis and can be performed by the element owners and their teams or by an external consultant.

Step 9: Write the Documents

• Written quality policy and procedure manuals should be prepared.

• This documentation of work instructions should be done by the employee who performs the job.

Step 10: Install the New System

• The policies, procedures and work instructions should be integrated into the day-to-day workings of the organization.

• Now the new system is installed.

Step 11: Internal Audit

• An internal audit of the quality system should be conducted.

• This step ensures that the system is working effectively and to provide management with information for the comprehensive management review.

Step 12: Management Review

• The management review should be conducted in order to determine the effectiveness of the system in achieving the stated quality goals.

Step 13: Pre-assessment

• The pre-assessment is an optional step. If a good job has been done on the previous steps, then pre-assessment is not necessary.

Step 14: Registration

• The registration activity include: choosing a register, submitting an application and conducting the register's system audit.

• While choosing a registrar, one should consider so many factors such as cost, lead time and customer’s acceptance of the registrar, the registrar's accreditation and familiarity with the industry.

• The application for registration should also include supplying the registrar with the policy and procedure manuals for their review.

• The time involved in the registrar's system audit will vary depending on the size and complexity of the organization and the number of auditors involved.

Step 15: Award of ISO 9000 Certificate

• After accepting the application and setting a time for registration, the registrar will review the quality system documentation.

• Based on the satisfactory report of the assessment team, license i.e., ISO certificate will be granted to the organization by ISO/ BIS to use the certification mark in letter heads, quality certificates, etc.

• The certificate awarded is normally valid for three years. During the period of validity, surveillance audits are conducted to ensure that the document quality system is being effectively maintained.

• The surveillance audits will not be full audits, but random checks of some elements to ensure that the system continues to function.