

MODULE - 4

CONTINUOUS PROCESS IMPROVEMENT:

Continuous improvement is an inherent part of TQM process. Continuous improvement is made by

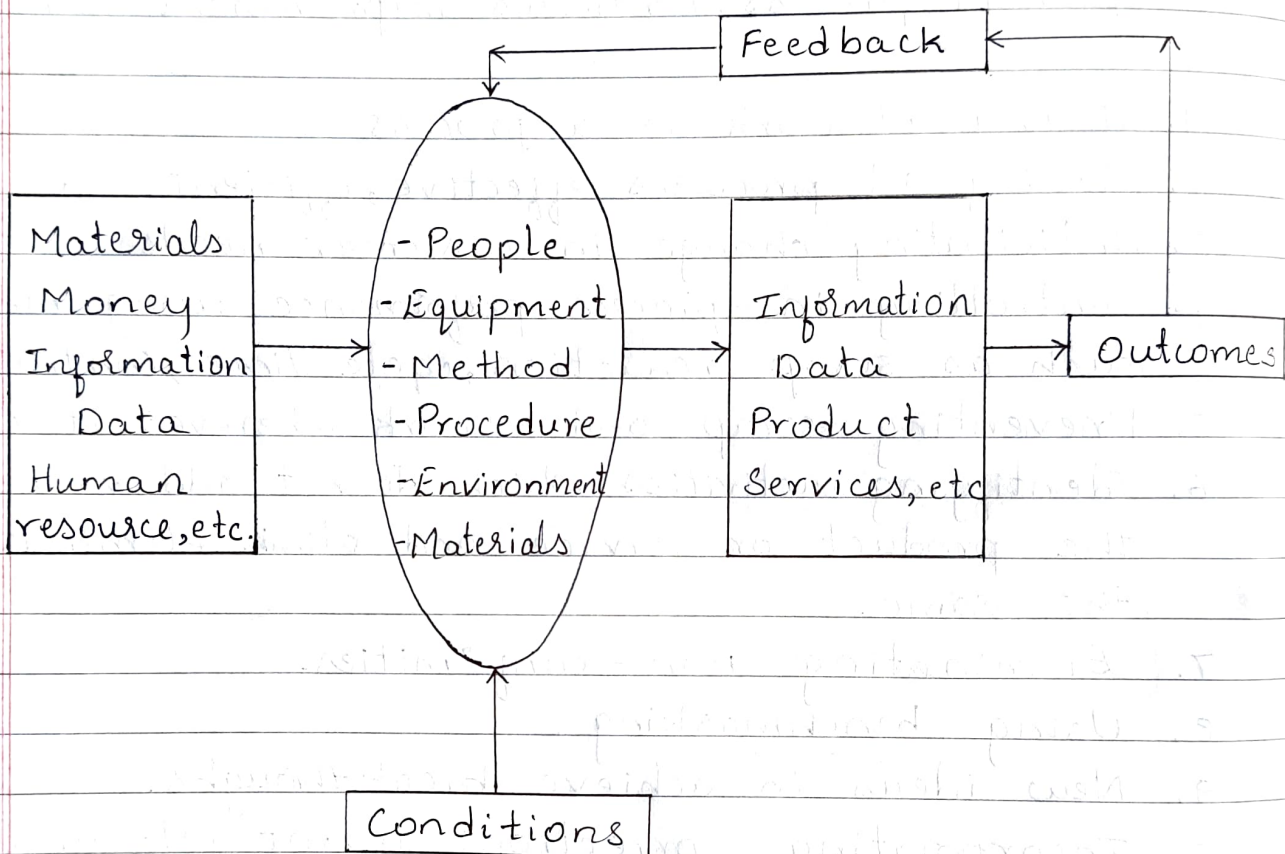
1. Viewing all work as a process
2. Making all processes effective, efficient and adaptable
3. Anticipating change in customer needs.
4. Controlling in-process performance using measures such as scrap reduction, cycle time, control charts
5. Preventing scrap and rework wherever it occurs.
6. Identifying activities which do not add value to the product or service and ~~eliminating~~ eliminating the same.
7. Eliminating non-conformities.
8. Using benchmarking
9. New ideas to achieve breakthroughs.
10. Incorporating corrections learnt into future activities.
11. Using technical tools such as SPC, DOE, benchmarking, QFD etc.

PROCESS:

Process refers to business and production activities of an organization. It is a sequence of various procedures which are interdependent and linked with each other and, consume one or more resources like 4Ms - Money, Material, Men, Machine at every stage of the business or production cycle to convert inputs in the

form of raw materials into outputs in the form of a product.

MODEL OF IMPROVEMENT PROCESS



There are five basic ways to improve business:

a) Minimize the consumption of resources:

It is important that all form of resources must be used in most effective manner.

b) Reduce errors:

Variation in the process causes errors to occur. It is important to work towards eliminating common causes of errors and minimize the special causes.

c) Meet or exceed the expectations of the customers:

d) Make the process safer:

Workers safeguarding is to be prioritized by making the process safer. This can be achieved by implementing safety measures, educating them on importance of safety measures.

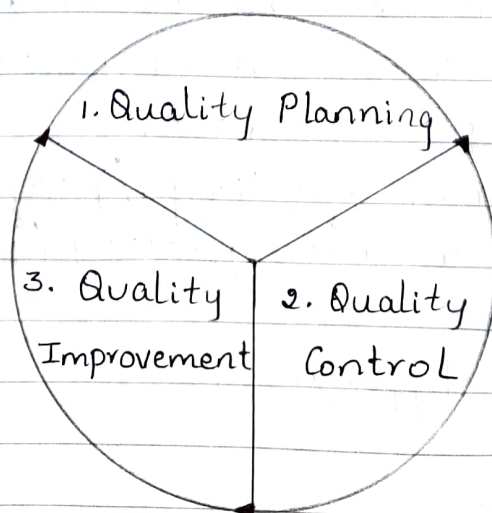
e) Make the process more satisfying to the person doing it

* Juran's Trilogy

It is an approach involving cross-functional management, managed by means of three managerial processes: quality planning, quality control, and quality improvement.

Juran developed the idea of the quality Trilogy to bring continuous improvement in the process. This has three components. They are.

1. Quality planning
2. Quality control
3. Quality improvement



1) Quality planning

- Identify the external customer.
- Find out their needs
- Translate those requirement into organization language
- Develop a product that can respond to those needs or requirements.
- Optimize the product features to meet the organization and customer needs.

The planning component begins with identification of external customer through marketing followed by identifying their needs. After identification of needs develop a product and/or service features that meets the customer's needs, with the help of multifunctional team. Optimize the product features to meet the customer's needs.

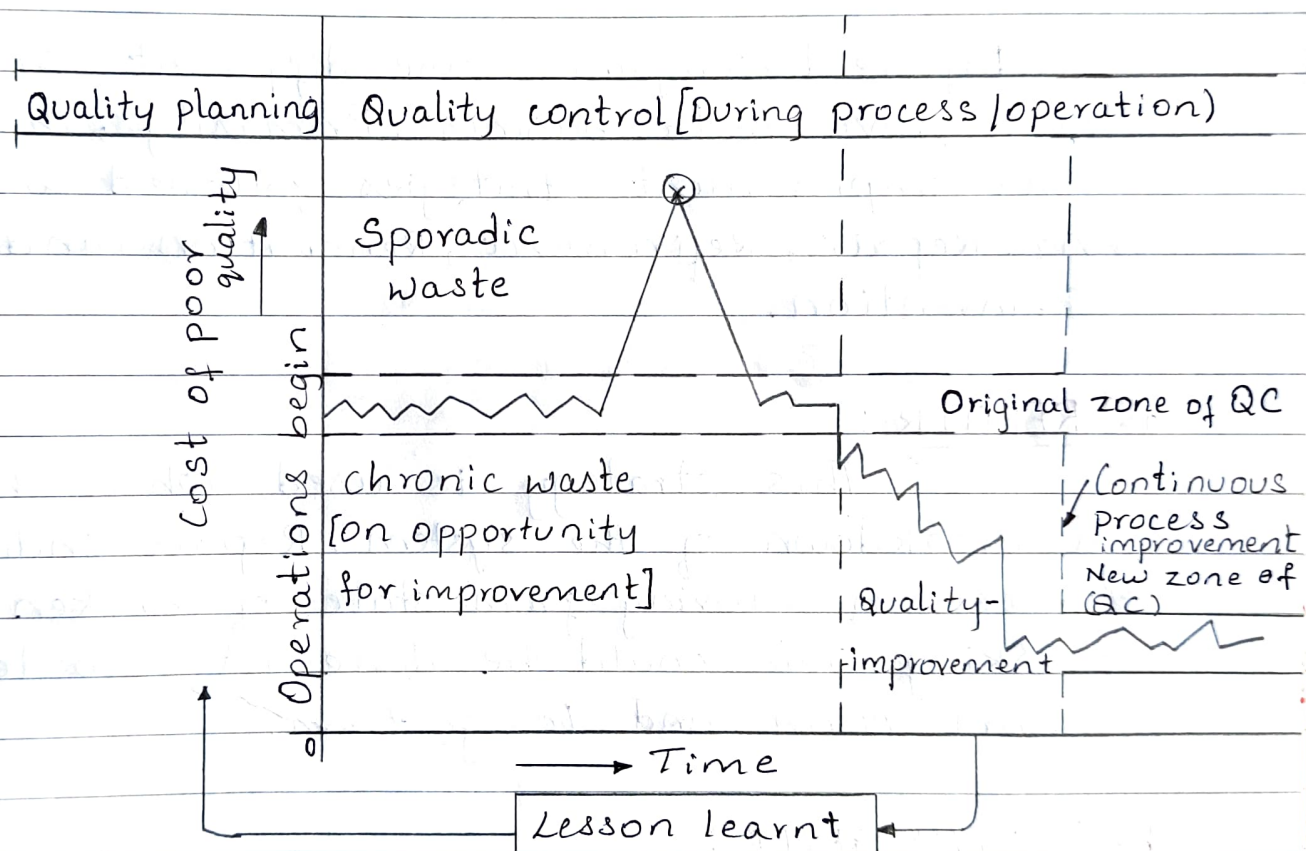
2) Quality Control

- Determine the items/subjects to be controlled and their unit of measure.
- Set goals for the controls and determine what system need to be put in place to measure the product, process or service.
- Measure actual quality / performance
- Compare the actual quality / performance with the goals.
- Act on the difference.

3) Quality Improvement:

- Aim to attain levels of performance/quality that are significantly higher than the present level.
- Optimize the process.

The Juran, Trilogy Diagram



This diagram provides a concept the inter-relation between the three continuous improvement processes i.e., quality planning, quality control and quality improvement. In this Juran has provided a distinction between sporadic waste and chronic waste. The sporadic waste can be identified and corrected through quality control. The Chronic waste in the beginning of the operation needs an improvement in the process.

As a solution is found through the improvement process, the lesson learnt is fed back to quality planning process so that new goals by reducing the chronic waste to the lowest possible level may be established.

→ IMPROVEMENT STRATEGIES:

Different companies use different strategies to improve their business. Primarily, there are four improvement strategies followed worldwide viz. Repair, Refinement, Renovation and Reinvention.

a) REPAIR:

This strategy is used when there is a breakdown of the system. Repair indicates the process of moving from state of broken to working. This could be done at two levels - short term and long term.

b) REFINEMENT:

If the system is not broken there is no need to repair it. However, certain activities need not be broken, but still fall back in terms of efficiency and effectiveness. Hence in this strategy, activities that promote the improvement of the efficiency and effectiveness of current process are involved.

c) Renovation:

Renovations are breakthrough improvements needed to meet the current expectations of the customer. It is achieved through innovation and advancements.

d) Reinvention

This strategy is applied, when the company realises that current products and services are not sufficient to satisfy the customer. In order to maintain the competitive advantage and sustain the vitality, organizations apply this strategy.

TYPES OF PROBLEM IN CONTINUOUS PROCESS IMPROVEMENT

Generally, five types of problems in continuous process improvement are observed. They are; Compliance, Unstructured, Efficiency, Process design and product design.

a) Compliance: This is a condition that occurs when a system through structured with proper inputs, process and outputs, is seen as unacceptable by a customer.

b) Unstructured: This problem is similar to compliance but is not specified by standards. In other words, when an immature system using unstructured inputs, process and output produces a product, customers will obviously reject it.

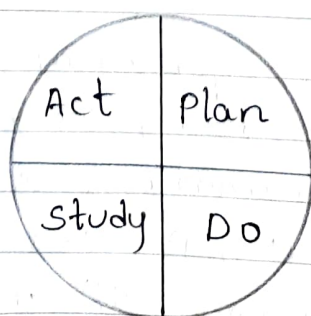
In order to fix such problem, companies used to conduct a customer survey before starting a product. This will eliminate the problem of poor performance of the company.

c) Efficiency: Companies after taking feedback from customers produce a product acceptable to them. This problem is solved by concentrating on reduction of the cost of production and providing safe working conditions for workers.

d) Process design: Current process used may not be sufficient to cater to the needs of the customer. Then, companies need to revise the existing processes or design and develop new processes to meet the expectations of the customers.

e) Product design: The choice of the customer about a product is unpredictable. Hence, companies need to re-think new ways of keeping them abreast. New problems occur as the facilities available with companies are not sufficient to produce or revise the new product.

* Plan - Do - Study - Act [PDSA] cycle



[PDSA - cycle]

To successfully practice TQM in an organization, the senior leaders/top level managers must take the first step i.e., accepting and committing themselves to the guidelines and point that forms the basis of TQM.

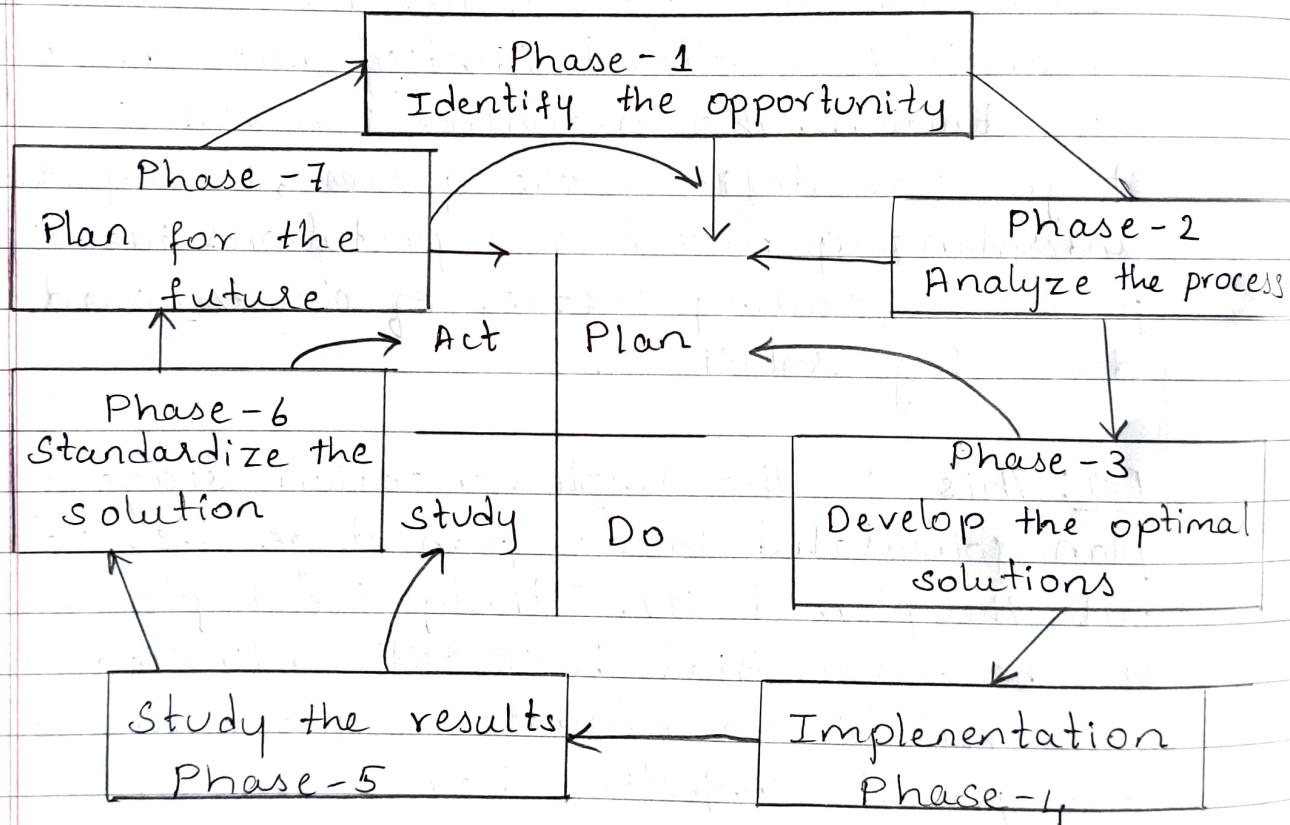
Plan: A problem is identified by studying the situations to detect the gap between the present and the future situations. A large gap can create significant opportunities for improvement. Senior leaders should identify methods to improve the situation. The activities involved in this stage are defining the process, its inputs, understanding customer expectations identifying problems, testing theories of causes and developing solutions.

Do: This is the implementation stage of the plan formulated in the plan stage i.e. to carry out the plan (do it). Initially the implementation will be on a trial basis with a limited customers. This trial is to evaluate a proposed solution and provide objective data to assess the full scale feasibility plan.

Study: This step deals with monitoring and inspecting results. It determines whether the trial plan is working properly and if any further problems or opportunities are found, the proposed solution must be modified or scrapped.

Act: This is the final step of PDCA cycle. In this step the manager review the information of the "study" step and initiates corrective action. The final plan is implemented and the improvement becomes standardized and used continuously.

PDCA cycle - Problem solving phases of continuous Process Improvement



PDCA cycle

PDCA cycle as shown in fig follows seven phases of continuous process improvement.

They are:

- Identify the opportunity
- Analyse the current process
- Develop the optimal solution.

- Implement change
- Study the result.
- Plan for the future
- Standardized the solution.

First three phases are parts of the plan stage, fourth phase is a part of the Do stage, fifth phase is the part of the study stage and last two phases make appearance in Act stage.

Phase - 1 : Identify the Opportunity

Key activities in this phase are to identify the problem, form a team to study the problem and define the scope of the problem that helps in prioritising.

Phase - 2 : Analyse the current process

Problems associated with processes identified in the previous phase, are analysed, the current process is thoroughly studied to understand its performance. A gap analysis is conducted to understand the loop holes of the current process.

Phase - 3 : Develop the Optimal solution

Here, taking the results of the previous phase an optimal solution is developed. Brain storming is conducted to discuss all possible solutions and the most optimal solution is selected to solve the problem.

Phase - 4: Implement change

This involves implementation of the solution developed in the previous phase.

Phase - 5: Study the Result

The implemented solution is studied through the collection of the relevant data. The data is reviewed through periodic meetings and evaluation of the result of implementation.

Phase - 6: Standardize the solution

Phase - 7: Plan for the future

If the solution yields improvement, the activities should lead to a continuous improvement. The activities should lead to a continuous improvement of the process.

Imai's Kaizen

Kaizen is a Japanese word for "Continuous improvement." It is a formal system to promote continuous improvement developed as a part of just-in-time (JIT) manufacturing techniques.

Kaizen is the process of continuous improvement in small increments, that makes the process more efficient, effective, under control, and adaptable. Improvement is accomplished at little or no expense, without sophisticated techniques or expensive equipment. It aims at simplification by breaking the complete processes into simple ones and improving on them.

The kaizen improvement focus on the following factors.

1. Identification of value-added and non-value added activities in the process.
2. Muda, which refers to seven classes of wastes: they being over production, delay, transportation, processing, inventory, motion and defective components.
3. Principles of time and motion study and cell technology.
4. Principles of materials handling and use of one piece flow.
5. Documentation of standard procedures.
6. The five S' for work place organization which have five Japanese words. They are
Seiko Proper arrangements
Seiton Orderliness
Swihetso Personal cleanliness
Seiso Cleanup
Shitsuke Discipline
7. Visual management for better communications.
8. Just-in-time (JIT) principles - to produce only the right units in right quantities, at the right time, and with right resources.
9. Poka-Yoke to prevent or detect errors.
10. Team dynamics, which includes problem solving, communication skill and conflict resolution.

Reengineering: The term "reengineering" is defined as "the fundamental rethinking and radical design of business processes to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality, service and speed". The

term is also known as "Process re-engineering" or "Business process re-engineering".

Reengineering is focused on "break through" improvement, dramatically improve the quality and speed of work and to reduce its cost by fundamentally changing the processes by which work gets done.

The three 'R's of Reengineering (three phase of Reengineering).

Reengineering effort involves three basic phases they are:

1. Rethink
2. Redesign
3. Retool.

Rethink: This phase involves examining the organization's current objectives and underlying rules and assumptions for determine how well they suit to the renewed commitment of customer satisfaction.

Redesign: This phase analyses the way the organization produce products or services. Then a determination is made as to which part of the process or which job is to be redesigned, so that the outcome will be more satisfying and are customer focused.

Retool : This phase involves the thorough evaluation of the current use of technologies, especially electronic data processing systems, to identify advanced opportunities for change in the technology to achieve the goal i.e. quality improvement and customer satisfaction.

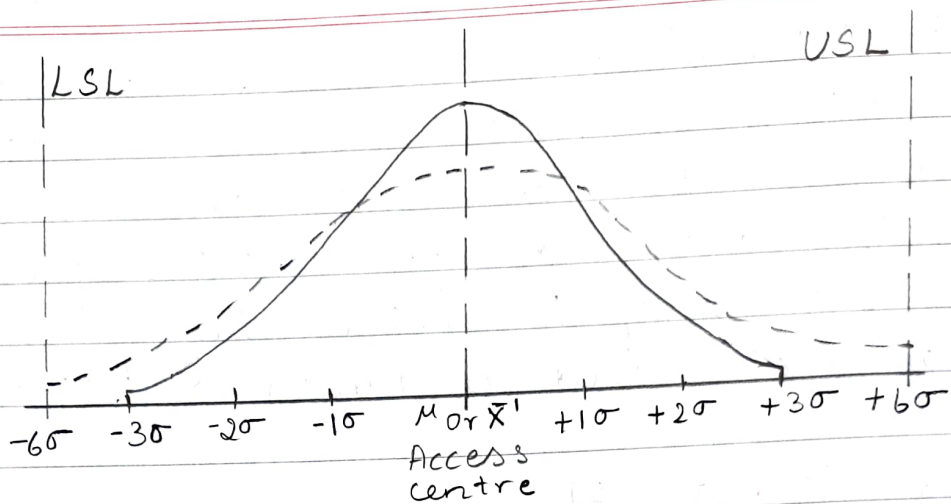
Six Sigma (6) :

Another technique employed to sustain continuous improvement is through Six sigma. Sigma ' σ ' is the notation used to represent Standard Deviation.

Six Sigma is a TQM process that uses process capability analysis as a way of measuring progress. In fact σ defines the shape of the frequency curve. Larger the value of σ , the curve will be broader and dispersion or spread of the process will be larger. Similarly smaller the value of σ , more peaked will be the curve.

Figure shows a process that is normally distributed centered at \bar{x} and LSL and USL established at $\pm 6\sigma$. Under this situation 99.999999 98% of the product will be within the specification limits (SL) i.e. 0.002 parts per million will be nonconformance or 2.0 pieces per billion. For this situation the process capability index C_p is 2.0

A C_p value of 1.33 has Table 2.1 shows the percent of area between specification. The



Area under normal curve of $\pm 6\sigma$

non-conformance rate, process capability for different specification limits. According to the six-sigma philosophy, processes are rarely centered i.e., the center tends to shift above or below the target \bar{x}' or μ .

Table 2.1

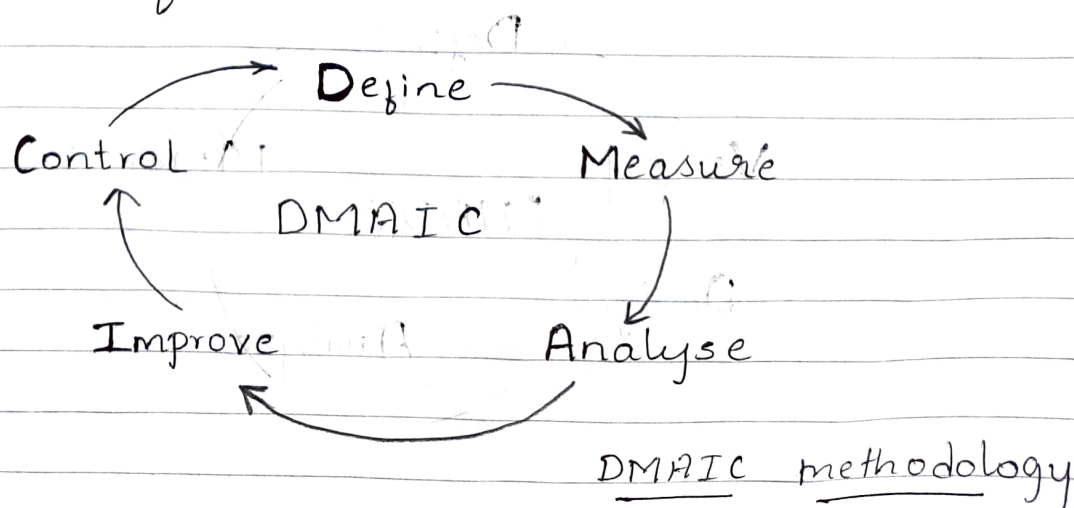
Specification Limit	Percent Conformance	Non Conformance Rate (PPm)	Process Capability CP
$\pm 1\sigma$	68.7	317300	0.33
$\pm 2\sigma$	95.45	485500	0.67
$\pm 3\sigma$	99.73	2700	1.00
$\pm 4\sigma$	99.9937	63	1.33
$\pm 5\sigma$	99.999943	0.57	1.67
$\pm 6\sigma$	99.9999998	0.002	2.00

Six Sigma Methodology

Six sigma follows two methodologies for improving quality of a process and design of a product. They are termed as:

- a) DMAIC - Define, Measure, Analyse, Improve, Control.
- b) DMADV - also known as DFSS (Design for six sigma) - Design, Measure, Analyse, design, verify.

DMAIC is a process improvement methodology. During first stage the system is properly defined by identifying proper objectives. In second stage, key and relevant data are collected to measure the performance of the current process. During Analyse, root cause of the problem is identified as to understand the reasons for generation of defects from the process. During Improve stage, optimal solution is identified and implemented to eliminate or minimize the root cause of the problem. Finally, during control stage, the implemented solution is continuously monitored with proper recording techniques to ensure that any deviation from the target are corrected before they result in defects.



DMADV is a product improvement methodology. This aims at producing a defect free product keeping requirements of customers in mind from a very stage of the product development. During **Define** stage, Project leaders identify most important needs and wants of customers by conducting a market survey. Then, during **Measure** stage, factors that critical to quality are measured. This stage ends with customer requirements being converted into project goals with critical design parameters. Next, **Analysis** stage involves development of alternative designs and selecting the optimal design with best components and making necessary adjustments in the process to make the best product. In the **Design** stage a prototype is developed and compared against the collected needs and wants of the customer. In the final step of **Verify** validation of the implemented design acceptable to all stakeholders is completed. The product is taken to higher levels from prototype. All lessons are properly documented.

