## Unit - 6 - Software Quality Management

Software quality management is a systematic process of ensuring that software meets the highest standards in terms of functionality, reliability, and user satisfaction. It is a disciplined approach to overseeing and enhancing all aspects of software development, deployment, and maintenance to ensure the final product meets or exceeds user expectations. It encompasses processes, standards, and practices that focus on functionality, performance, reliability, and user satisfaction, ultimately creating high-quality software products.

Software Quality Management (SQM) is the process of constant improvement of product quality, integrated into the development process until the expectations are achieved. Software quality management aims to create a working environment where quality is the responsibility of everyone on the team.

### Total Quality Management

Total Quality Management (TQM) is a management approach that seeks to provide long-term success by providing customer satisfaction through the constant delivery of quality IT services. To properly execute TQM methods, the entire organization needs to operate as a single unit in the search of quality.


### Principles of TQM:

1. **Customer first:** TQM's first and foremost pillar of success is an unwavering focus on the customer's experience in all interactions with the organization. From first contact through purchase and continued support, the customer should always be the main priority.
2. **Employee ownership:** TQM requires the involvement of every team member to ensure that complete quality control is offered at every level. TQM doesn't focus on a single department because the goal is to provide customers with a great experience from every level of the organization.
3. **Process-based:** TQM focuses on the creation and implementation of processes that provide organizations with the ability to find success and repeat it. Quantifying success and defining the steps taken to get there are essential for successful implementation of TQM.
4. **System integration:** TQM strategies revolve around leveraging every asset available to the company. This is best achieved through system integrations that combine disparate parts of the organization into a single, well-oiled machine working in complete synergy.
5. **Communication:** TQM requires every team member to be at their best and to function as a value-adding member of that team. This means communication and transparency is a core tenet of successful TQM practices.
6. **Data-driven:** TQM doesn't employ guesswork. Instead, data is leveraged for the improvement of the organization and decisions are made based on quantifiable facts.
7. **Constant improvement:** TQM isn't a one and done process. Perfection is impossible, so it must always be pursued to get the organization as close as possible to it.

**Why Software Quality Management is Important?**

Software Quality Management is important because it helps to identify and correct errors in software, which is essential for the effective implementation of a project. The quality of the software is simply the measurement of how well the product has been able to fulfill your needs.

It is measured by how often errors are found and repaired, how well the software works under different conditions, and how easily software can be maintained.

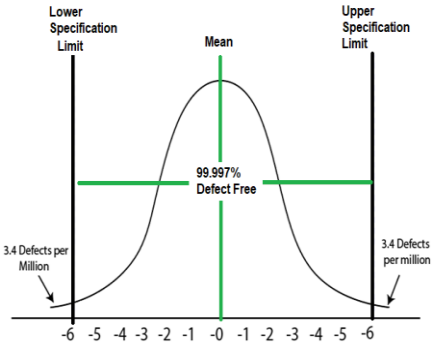
Software quality is determined by comparing actual results against the expected results. If a project fails to meet its objectives because of poor quality, then the project will be a failure. Software quality can include a large variety of factors such as degree of completeness, efficiency, usability, correctness, and reliability.

**5 Aspects of Software Quality:**

Software quality can be measured in terms of its ability to perform its required functions and meet its specified requirements. The five aspects of software quality are:

1. **Performance:** Performance refers to how well a system performs its functions or meets user requirements.
2. **Usability:** Usability relates to the ease with which users can use the system and understand it.
3. **Reliability:** Reliability relates to the ability of a system to continue operating without breakdown or failure.
4. **Maintainability:** Maintainability refers to how easy it is to understand and modify code so that changes can be made easily when necessary.
5. **Interoperability:** Interoperability refers to whether a system will work with other systems or programs without difficulty or incompatibility issues.

**Six Sigma(6σ)**



Six Sigma Curve

Six Sigma is a business methodology for quality improvement that measures how many defects there are in a current process and seeks to systematically eliminate them. Six Sigma is the process of improving the quality of the output by identifying and eliminating the cause of defects and reducing variability in manufacturing and business processes. The maturity of a manufacturing process can be defined by a sigma rating indicating its percentage of defect-free products it creates. A six-sigma method is one in which **99.99966%** of all the opportunities to produce some features of a component are statistically expected to be free of defects *(3.4 defective features per million opportunities)*.

**Characteristics of Six Sigma**

1. **Statistical Quality Control:** Six Sigma is derived from the Greek Letter σ (Sigma) from the Greek alphabet, which is used to denote Standard Deviation in statistics. Standard Deviation is used to measure variance, which is an essential tool for measuring non-conformance as far as the quality of output is concerned.

2. **Methodical Approach:** The Six Sigma is not merely a quality improvement strategy in theory, as it features a well-defined systematic approach of application in DMAIC and DMADV which can be used to improve the quality of production. DMAIC is an acronym for Design-Measure- Analyze-Improve-Control. The alternative method DMADV stands for Design-Measure- Analyze-Design-Verify.
3. **Fact and Data-Based Approach:** The statistical and methodical aspect of Six Sigma shows the scientific basis of the technique. This accentuates essential elements of the Six Sigma that is a fact and data based.
4. **Project and Objective-Based Focus:** The Six Sigma process is implemented for an organization's project tailored to its specification and requirements. The process is flexed to suit the requirements and conditions in which the projects are operating to get the best results.
5. **Customer Focus:** The customer focus is fundamental to the Six Sigma approach. The quality improvement and control standards are based on specific customer requirements.
6. **Teamwork Approach to Quality Management:** The Six Sigma process requires organizations to get organized when it comes to controlling and improving quality. Six Sigma involves a lot of training depending on the role of an individual in the Quality Management team.

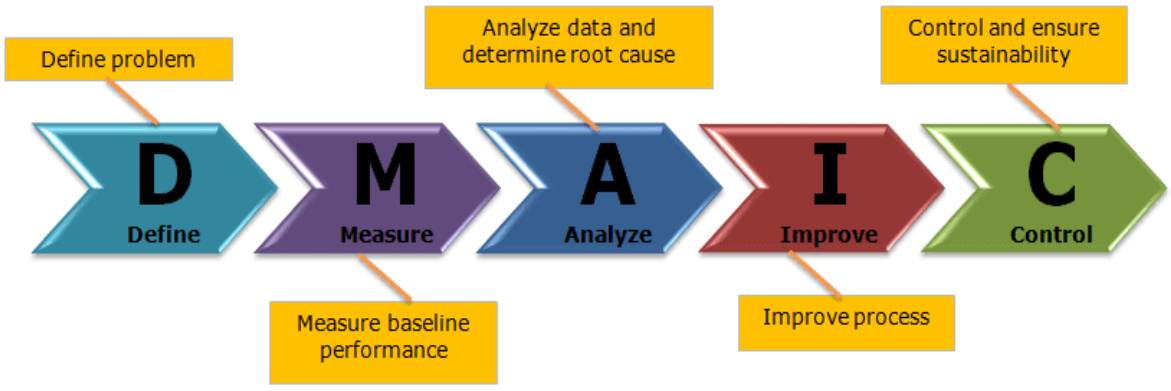
**Six Sigma Methodologies**

Six Sigma projects follow two project methodologies:

1. DMAIC
2. DMADV

**1. DMAIC**

It specifies a data-driven quality strategy for improving processes. This methodology is used to enhance an existing business process. The DMAIC project methodology has five phases:

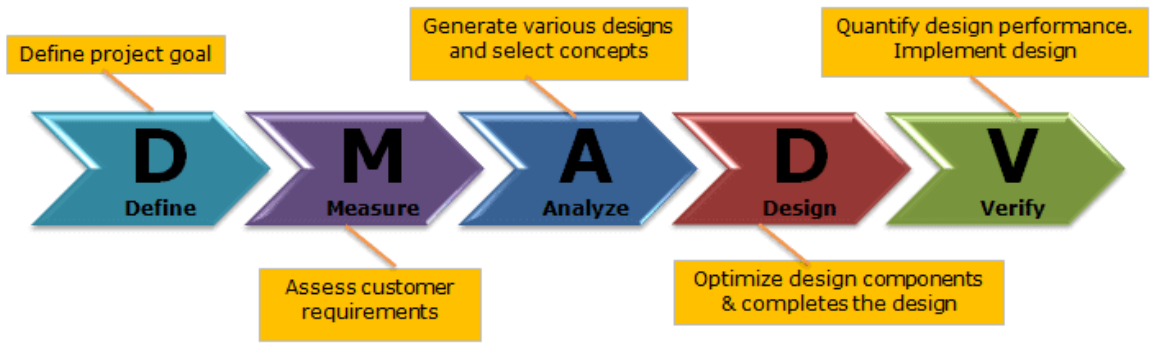



1. **Define:** It covers the process mapping and flow-charting, project charter development, problem-solving tools, and so-called 7-M tools.
2. **Measure:** It includes the principles of measurement, continuous and discrete data, and scales of measurement, an overview of the principle of variations and repeatability and reproducibility (RR) studies for continuous and discrete data.

3. **Analyze:** It covers establishing a process baseline, how to determine process improvement goals, knowledge discovery, including descriptive and exploratory data analysis and data mining tools, the basic principle of Statistical Process Control (SPC), specialized control charts, process capability analysis, correlation and regression analysis, analysis of categorical data, and non-parametric statistical methods.
4. **Improve:** It covers project management, risk assessment, process simulation, and design of experiments (DOE), robust design concepts, and process optimization.
5. **Control:** It covers process control planning, using SPC for operational control and PRE-Control.

**2. DMADV**

It specifies a data-driven quality strategy for designing products and processes. This method is used to create new product designs or process designs in such a way that it results in a more predictable, mature, and detect free performance. The DMADV project methodology has five phases:




1. **Define:** It defines the problem or project goal that needs to be addressed.
2. **Measure:** It measures and determines the customer's needs and specifications.
3. **Analyze:** It analyzes the process to meet customer needs.
4. **Design:** It can design a process that will meet customer needs.
5. **Verify:** It can verify the design performance and ability to meet customer needs.

**ISO 9126 Software Quality Characteristics:**

ISO 9126 is an international standard for the evaluation of software. The standard is divided into four parts which addresses, respectively, the following subjects: quality model; external metrics; internal metrics; and quality in use metrics. This software is profoundly used in a widespread way to embrace various models and metrics. The recommended features describe externally when software is found to be a result of attributes of internal attributes of software. The ISO 9126–1 software quality model identifies 6 main quality characteristics. They are:

1. Functionality
2. Reliability
3. Usability
4. Efficiency
5. Maintainability
6. Portability