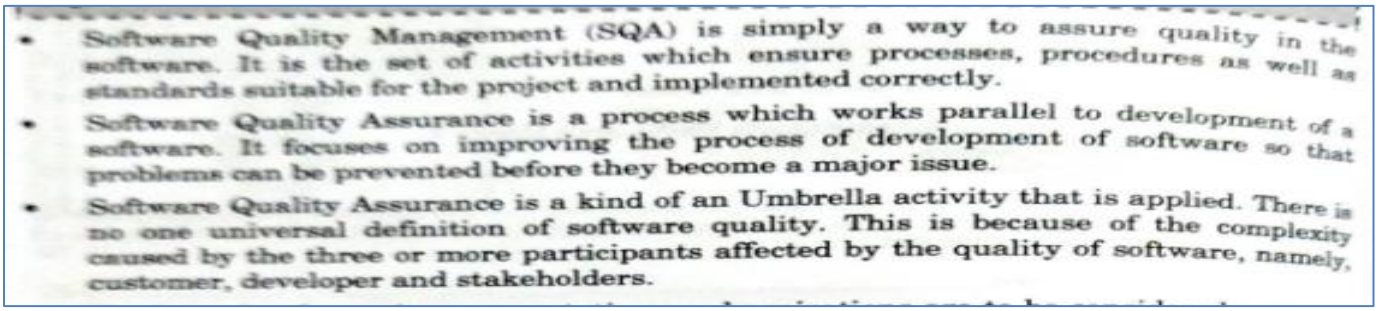
Chap 06 Quality Management

Software Quality Management:



- Software Quality Management (SQA) is simply a way to assure quality in the software. It is the set of activities which ensure processes, procedures as well as standards suitable for the project and implemented correctly.
- Software Quality Assurance is a process which works parallel to development of a software. It focuses on improving the process of development of software so that problems can be prevented before they become a major issue.
- Software Quality Assurance is a kind of an Umbrella activity that is applied. There is no one universal definition of software quality. This is because of the complexity caused by the three or more participants affected by the quality of software, namely, customer, developer and stakeholders.

Software Quality Management ensures that the required level of quality is achieved by submitting improvements to the product development process. SQA aims to develop a culture within the team and it is seen as everyone's responsibility.

Software Quality management should be independent of project management to ensure independence of cost and schedule adherences. It directly affects the process quality and indirectly affects the product quality.

Activities of Software Quality Management:

- Quality Assurance - QA aims at developing Organizational procedures and standards for quality at Organizational level.
- Quality Planning - Select applicable procedures and standards for a particular project and modify as required to develop a quality plan.
- Quality Control - Ensure that best practices and standards are followed by the software development team to produce quality products.

Software Quality Management System

Software Quality Management System contains the methods that are used by the authorities to develop products having the desired quality.

Managerial Structure: Quality System is responsible for managing the structure as a whole. Every Organization has a managerial structure.

Individual Responsibilities: Each individual present in the organization must have some responsibilities that should be reviewed by the top management and each individual present in the system must take this seriously.

Quality System Activities: The activities which each quality system must have been

- Project Auditing
- Review of the quality system
- It helps in the development of methods and guidelines

Evolution of Quality Management System

Quality Systems are basically evolved over the past some years. The evolution of a Quality Management System is a four-step process.

The main task of quality control is to detect defective devices and it also helps in finding the cause that leads to the defect. It also helps in the correction of bugs.

Quality Assurance helps an organization in making good quality products. It also helps in improving the quality of the product by passing the products through security checks.

Total Quality Management(TQM) checks and assures that all the procedures must be continuously improved regularly through process measurements.

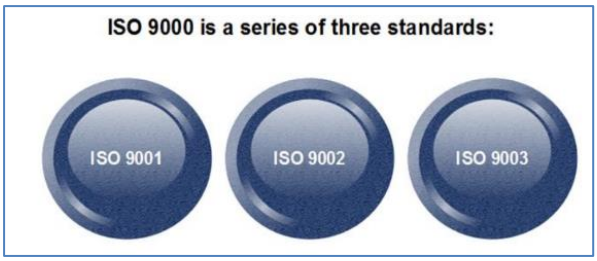
ISO:

The International organization for Standardization is a world wide federation of national standard bodies. The International standards organization (ISO) is a standard which serves as a for contract between independent parties. It specifies guidelines for development of quality system.

- Quality system of an organization means the various activities related to its products or services. Standard of ISO addresses to both aspects i.e. operational and organizational aspects which includes responsibilities, reporting etc. An ISO 9000 standard contains set of guidelines of production process without considering product itself.

- ISO (International Standards Organization) is a group or consortium of 63 countries established to plan and fosters standardization. ISO declared its 9000 series of standards in 1987.
- It serves as a reference for the contract between independent parties. The ISO 9000 standard determines the guidelines for maintaining a quality system.
- The ISO standard mainly addresses operational methods and organizational methods such as responsibilities, reporting, etc.
- ISO 9000 defines a set of guidelines for the production process and is not directly concerned about the product itself

Types of ISO 9000 Quality Standards:



The ISO 9000 series of standards is based on the assumption that if a proper stage is followed for production, then good quality products are bound to follow automatically. The types of industries to which the various ISO standards apply are as follows.

1. ISO 9001: This standard applies to the organizations engaged in design, development, production, and servicing of goods. This is the standard that applies to most software development organizations.
2. ISO 9002: This standard applies to those organizations which do not design products but are only involved in the production. Examples of these category industries contain steel and car manufacturing industries that buy the product and plants designs from external sources and are engaged in only manufacturing those products. Therefore, ISO 9002 does not apply to software development organizations.
3. ISO 9003: This standard applies to organizations that are involved only in the installation and testing of the products. For example, Gas companies.

How to get ISO 9000 Certification?

An organization determines to obtain ISO 9000 certification applies to ISO registrar office for registration. The process consists of the following stages:

1. Application: Once an organization decided to go for ISO certification, it applies to the registrar for registration.
2. Pre-Assessment: During this stage, the registrar makes a rough assessment of the organization.
3. Document review and Adequacy of Audit: During this stage, the registrar reviews the document submitted by the organization and suggest an improvement.
4. Compliance Audit: During this stage, the registrar checks whether the organization has compiled the suggestion made by it during the review or not.
5. Registration: The Registrar awards the ISO certification after the successful completion of all the phases.
6. Continued Inspection: The registrar continued to monitor the organization time by time.

🔑**Why ISO Certification required by Software Industry**? There are several reasons why software industry must get an ISO certification. Some of reasons are as follows:

- This certification has become a standards for international bidding.
- It helps in designing high-quality repeatable software products.
- It emphasis need for proper documentation.
- It facilitates development of optimal processes and totally quality measurements.

🌡**Features of ISO 9001 Requirements**:

- Document control – All documents concerned with the development of a software product should be properly managed and controlled.
- Planning – Proper plans should be prepared and monitored.
- Review – For effectiveness and correctness all important documents across all phases should be independently checked and reviewed .
- Testing – The product should be tested against specification.
- Organizational Aspects – Various organizational aspects should be addressed e.g., management reporting of the quality team.

Advantages of ISO 9000 Certification: Some of the advantages of the ISO 9000 certification process are following :

1. Business ISO-9000 certification forces a corporation to specialize in <how they are doing business=. Each procedure and work instruction must be documented and thus becomes a springboard for continuous improvement.
2. Employees morale is increased as they're asked to require control of their processes and document their work processes
3. Better products and services result from continuous improvement process.
4. Increased employee participation, involvement, awareness and systematic employee training are reduced problems.

McCall's quality factors and Criteria:

McCall's Software Quality Model was introduced in 1977. This model is incorporated with many attributes, termed as software factors, which influence software. The model distinguishes between two levels of quality attributes:

- Quality Factors
- Quality Criteria

Quality Factors: The higher-level quality attributes which can be accessed directly are called quality factors. These attributes are external attributes. The attributes at this level are given more importance by the users and managers.

Quality Criteria: The lower or second-level quality attributes that can be accessed either subjectively or objectively are called Quality Criteria. These attributes are internal attributes. Each quality factor has many second-level of quality attributes or quality criteria.

Example: The usability quality factor is divided into operability, training, communicativeness, input/output volume, and input/output rate. This model classifies all software requirements into 11 software quality factors. The 11 factors are organized into three product quality factors: Product Operation, Product Revision, and Product Transition.

Factors of Product Quality

Below are the factors of Product Quality, that are discussed in detail.

Product Operation

It includes five software quality factors, which are related to the requirements that directly affect the operation of the software such as operational performance, convenience, ease of usage, and correctness. These factors help in providing a better user experience.

- Correctness: The extent to which software meets its requirements specification.
- Efficiency: The number of hardware resources and code the software, needs to perform a function.
- Integrity: The extent to which the software can control an unauthorized person from accessing the data or software.
- Reliability: The extent to which software performs its intended functions without failure.
- Usability: The extent of effort required to learn, operate and understand the functions of the software.

Product Revision

It includes three software quality factors, which are required for testing and maintenance of the software. They provide ease of maintenance, flexibility, and testing effort to support the software to be functional according to the needs and requirements of the user in the future.

- Maintainability: The effort required to detect and correct an error during the maintenance phase.
- Flexibility: The effort needed to improve an operational software program.
- Testability: The effort required to verify software to ensure that it meets the specified requirements.

Product Transition

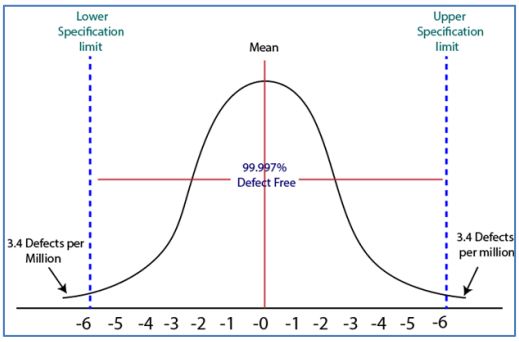
It includes three software quality factors, that allow the software to adapt to the change of environments in the new platform or technology from the previous.

- Portability: The effort required to transfer a program from one platform to another.
- Re-usability: The extent to which the program's code can be reused in other applications.
- Interoperability: The effort required to integrate two systems with one another.

SIX sigma:

Six Sigma is the process of improving the quality of the output by identifying and eliminating the cause of defects and reduce 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).



History of Six Sigma

- Six-Sigma is a set of methods and tools for process improvement. It was introduced by Engineer Sir Bill Smith while working at Motorola in 1986. In the 1980s, Motorola was developing Quasar televisions which were famous, but the time there was lots of defects which came up on that due to picture quality and sound variations.
- By using the same raw material, machinery and workforce a Japanese form took over Quasar television production, and within a few months, they produce Quasar TV's sets which have fewer errors. This was obtained by improving management techniques.
- Six Sigma was adopted by Bob Galvin, the CEO of Motorola in 1986 and registered as a Motorola Trademark on December 28, 1993, then it became a quality leader.

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 a merely 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 suits 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 involving 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**

DMAIC:

It specifies a data-driven quality strategy for improving processes. This methodology is used to enhance an existing business process.

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

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.

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.