Standardization

By: MSMZ

Introduction

- A standard is a document. It is a set of rules that control how people should develop and manage materials, products, services, technologies, processes and systems.
- Every organization would like to improve the way it operates, whether that means driving costs down, managing risk more effectively or improving customer satisfaction.
- When developing software for some large organizations, especially government organizations, following one of the standards is mandatory.

- One indication of the importance of standards is the current trend in software development tenders, which requires certification of participants according to at least one of the dominant quality management standards.

ISO

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Introduction

- The International Organisation of Standardisation (ISO) is a worldwide organisation that develops ISO standards.
- By now, most manufacturers are familiar with the ISO 9000 standards.
- This series of standards was first introduced in 1987 (ISO 9000:1987) and was revised in 1994 (ISO 9000:1994) and 2000 (ISO 9000:2000).

ISO 9000:2000

- ISO 9000 applies to all types of organisations. It does not matter what size they are or what they do.
  - It can help both product- and service-oriented organisations achieve standards of quality that are recognised and respected throughout the world.

- ISO 9000 has two different meanings :-

  1) refers to a single standard (ISO 9000)
     - ISO 9000 is a series of standards for the management of quality systems in almost any type of organization.

  2) refers to a set of three standards (ISO 9000, ISO 9001 and ISO 9004)

1. ISO 9000 Fundamentals and Vocabulary.

   This introduces the user to the concepts behind the management systems and specifies the terminology used.

2. ISO 9001 Requirements.

   This sets out the criteria you will need to meet if you wish to operate in accordance with the standard and gain certification.

3. ISO 9004 Guidelines for Performance Improvement.

   Based upon the eight quality management principles, these are designed to be used by senior management as a framework to guide their organizations towards improved performance.

Quality Management System

- Quality Management System (QMS) is defined by ISO 9000:2000 as a management system which directs and controls an organization with regard to quality.
- It is the organisational structure of responsibilities, activities, resources and events that together provide procedures and methods of implementation to ensure the capability of an organization to meet quality requirements.

- The first thing that the ISO 9001:2000 requires is for an organization to set up a full set of documents, which comprises the QMS, and to describe the organizations standards.
- In order to be successful, an organisation must prove that it is capable of producing the product to the customer's complete satisfaction so that it conforms exactly to the customer's specific requirements, and that it is always of the desired quality.

Requirements of a Quality Management System

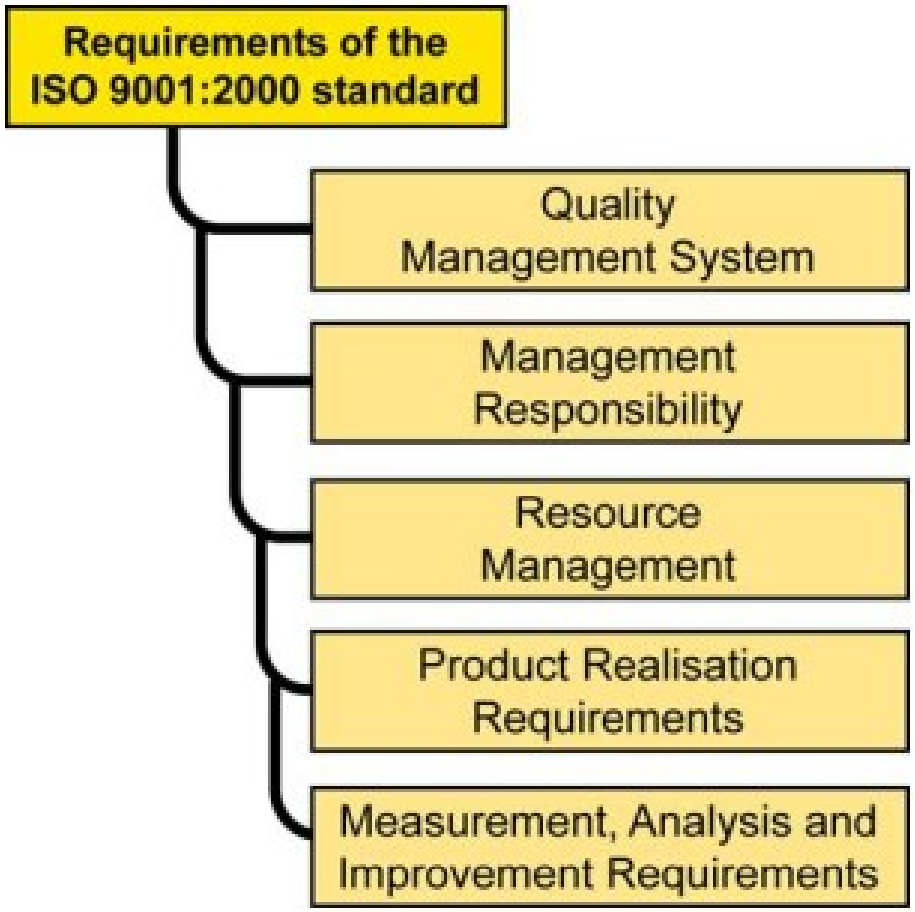

Figure 2.1: Five sections where the requirements of the ISO 9001:2000 standard are grouped into.

ISO 9000-3

- Compliance to quality management standards supports the organization's steady efforts to assure an acceptable quality level for software products.
- Represent implementation of the general methodology of quality management ISO 9000 Standards to the special case of software development and maintenance.

- ISO 9001 was designed to be a generic standard, applicable to any business. As a result, it may be difficult to interpret the twenty requirements for a specific industry. In addition, 9001 has a "manufacturing" focus.
- Computer software development has unique characteristics within research and development and engineering disciplines, further challenging the design of ISO-complaint quality assurance systems.
- These software-specific differences include the intangible nature of the software product, potential complexity of the software, potential complexity in the interaction among software subsystems and software—hardware subsystems, and a unique product life cycle. To help address the additional challenges faced by software development organizations, ISO developed 9000-3

Eight principles guide ISO 9000-3 standard

1. **Customer focus**. Organizations depend on their customers and therefore should understand current and future customer needs.
2. **Leadership.** Leaders establish the organization's vision. They should create and maintain an internal environment in which people can become fully involved in achieving the organization's objectives
3. **Involvement of people.** People are the essence of an organization; their full involvement, at all levels of the organization, enables their abilities to be applied for the organization's benefit.
4. **Process approach**. A desired result is achieved more efficiently when activities and resources are managed as a process.
5. **System approach to management**. Identifying, understanding and managing processes, if viewed as a system, contributes to the organization's effectiveness and efficiency.
6. **Continual improvement**. Ongoing improvement of overall performance should be high on the organization's agenda.
7. **Factual approach to decision making.** Effective decisions are based on the analysis of information.
8. **Mutually supportive supplier relationships.** An organization and its suppliers are interdependent; a mutually supportive relationship enhances the ability of both to create added value.

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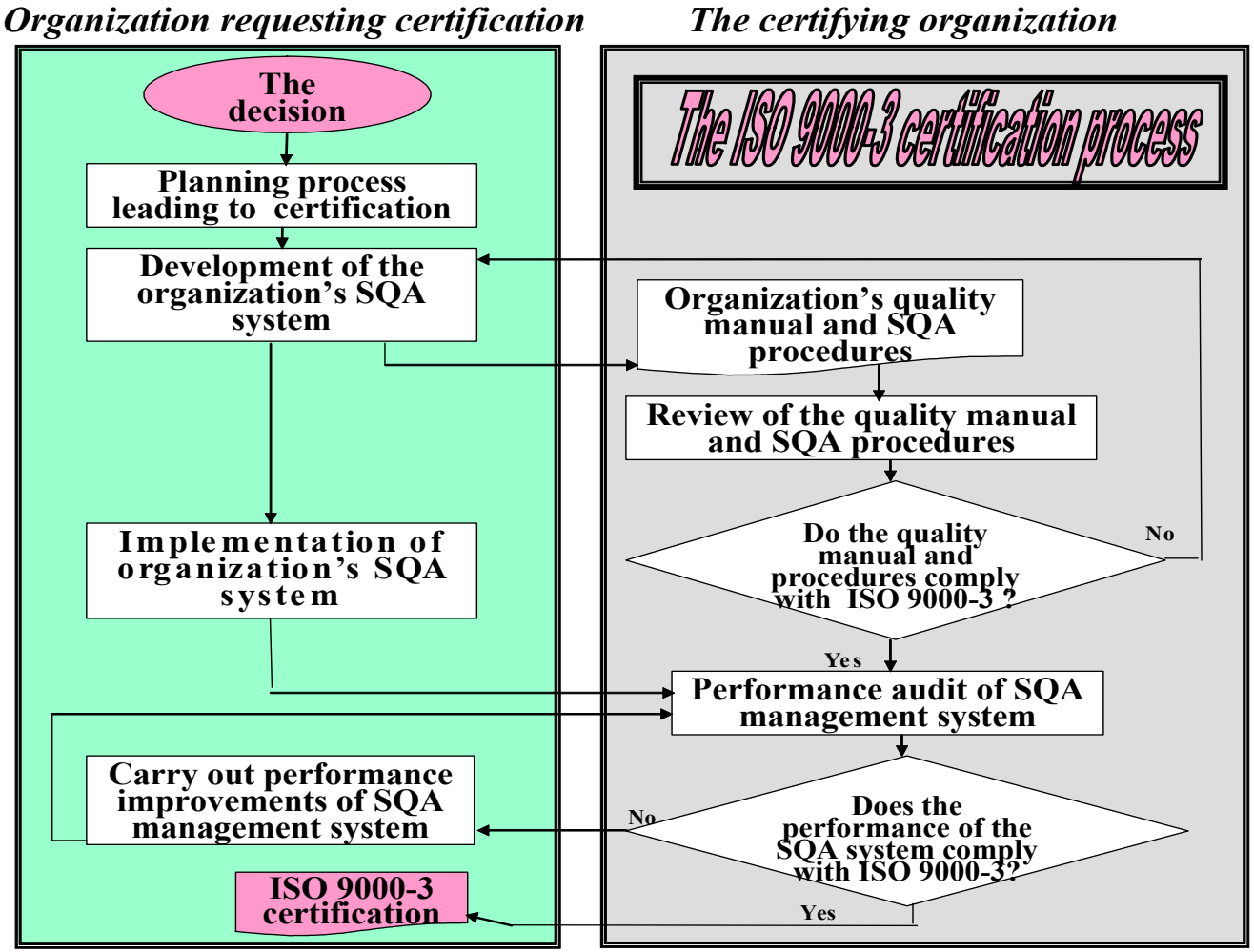
Certification according to ISO 9000-3



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Planning the process leading to certification

- Once management has made its decision to obtain ISO 9000-3 certification for its software development and maintenance activities, an action plan is needed
  - Do an internal survey of the current SQA system and how it is implemented.
- After completing the previous analysis, the plan for obtaining certification can be constructed. It should include:
  - A list of activities to be performed, including timetables
  - Estimates of resources required to carry out each activity
  - Organizational resources: (a) internal participants – SQA unit staff (including staff to be recruited) and senior software engineers; (b) SQA consultants.

Development of the organization's SQA system

- The organization's SQA management system should be developed to a level adequate to meet ISO 9000-3 requirements.
- Development of a quality manual and a comprehensive set of SQA procedures.
- Development of other SQA infrastructure:
  - Staff training and instruction programs, including staff certification programs
  - Preventive and corrective actions procedures, including the CAB committee
  - Configuration management services, including a software change control management unit
  - Documentation and quality record controls.
- Development of a project progress control system.

Implementation of the organization's SQA system

- Once the components of the SQA management system conform to certification demands, efforts are shifted towards implementing the system.
- These include setting up a staff instruction program and support services appropriate to the task of solving problems that may arise when implementing SQA tools.
- These arrangements are targeted especially at team leaders and unit managers, who are expected to follow up and support the implementation efforts made by their units.

Undergoing the certification audits

- The certification audits are carried out in two stages:
  1. *Review of the quality manual and SQA procedures developed by the organization.*
     - In cases of non-compliance with standards, the organization is obligated to complete the corrections prior to advancing to the second stage of certification.
  2. *Verification audits of compliance with the requirements defined by the organization in its quality manual and SQA procedures*
     - The main questions to be answered are:
     - Have the staff been adequately instructed on SQA topics and do they display a satisfactory level of knowledge?
     - Have the relevant procedures – project plans, design reviews, progress reports, etc. – been properly and fully implemented by the development teams?
     - Have documentation requirements been fully observed?

Organisational Implementation of the Standard

- Why should your organisation use the Standard? An honest reply can say a lot about how effectively the Standard can improve your business.
- *If you are using the Standard for marketing purposes, such as a plaque on the wall, a logo on a website or just because a customer requires it, then the Standard will be a burden, not a benefit.*
- If the reason for implementing the Standard is to improve your work or business process, then it can truly help your organisation become better.

Benefits of Standard Implementation

- Improves customer focus and process orientation within the organization
- Facilitates continuous improvement
- Improves business performance and manages business risk.
- Attracts investment, enhances brand reputation and removes barriers to trade.
- Improving customer satisfaction
- Building stable processes.

CMMI

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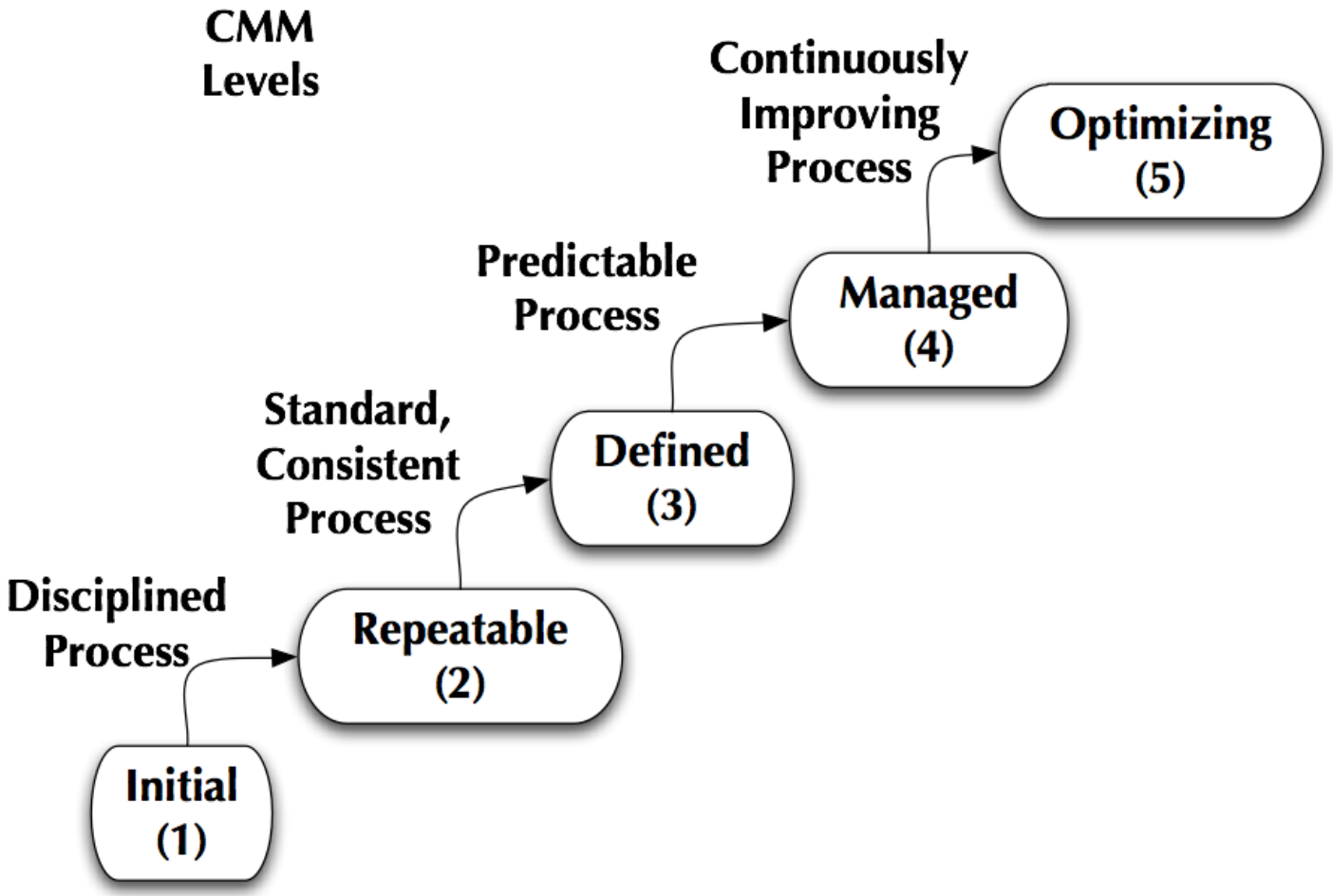
CMMI

- Capability Maturity Model Integration (CMMI) is a process level improvement training and appraisal program.
- Software Engineering Institute (SEI) at Carnegie Mellon University introduced the capability maturity model for software (CMM) to help improve software development processes.
- The CMM covers practices for planning, engineering and managing software development and maintenance. When followed, these key practices improve the ability of organisations to meet goals for cost, schedule, functionality and product quality

Capability Maturity Models

- As organisations improve the software processes by which they develop and maintain their software work products, they progress through levels of maturity.
- There are five maturity levels of the CMM, each maturity level provides a layer in the foundation for continuous process improvement.

CMMI Levels


CMM
Levels
Continuously
Improving
Process
Optimizing
(5)
Predictable
Process
Managed
(4)
Standard,
Consistent
Process
Defined
(3)
Disciplined
Process
Repeatable
(2)
Initial
(1)

- Level 1 -The Initial Level
  - At the Initial Level, the organisation typically does not provide a stable environment for developing and maintaining software.
  - The software process capability of Level 1 organisations is unpredictable because the software process is constantly changed or modified as the work progresses.
  - Schedules, budgets, functionality and product quality are generally unpredictable.

- Level 2- The Repeatable Level
  - At the Repeatable Level, policies for managing a software project and procedures to implement those policies are established.
  - Planning and managing new projects are based on experience with similar projects.
  - An objective in achieving Level 2 is to implement effective management processes for software projects, which allow organisations to repeat successful practices developed in earlier projects

- Level 3 - The Defined Level
  - At the Defined Level, the standard process for developing and maintaining software across the organisation is documented.
  - There is a group that is responsible for the organisation's software process activities.
  - An organisation wide training programme is implemented to ensure that the staff and managers have the knowledge and skills required to fulfill their assigned roles.
  - Processes established at Level 3 are used to help the software managers and technical staff to perform more effectively.

- Level 4 - The Managed Level
  - At the Managed Level, the organisation sets quantitative quality goals for both software products and processes.
  - Productivity and quality are measured for important software process activities across all projects as part of an organisational measurement program.
  - The software process capability of Level 4 organizations can be summarized as predictable because the process is measured and operates within measurable limits.

- Level 5 - The Optimizing Level
  - At the Optimising Level, the entire organisation is focused on continuous process improvement.
  - The organisation has the means to identify weaknesses and strengthen the process proactively, with the goal of preventing the occurrence of defects.
  - The software process capability of Level 5 organisations can be characterised as continuously improving because Level 5 organisations are continuously striving to improve the range of their process capability

Table 6.1: Five Levels in the CMMI Process

Level	Focus	Process Areas
5-Optimising	Continuous Process Improvement	• Organisational Innovation and Deployment • Causal Analysis and Resolution
4-Quantitatively Managed	Quantitative Management	• Organisational Process Performance • Quantitative Project Management
3-Defined	Process Standardisation	• Requirements Development • Technical Solution • Product Integration • Verification

		• Validation • Organisational Process Focus • Organisational Process Definition • Organisational Training • Integrated Project Management • Risk Management • Decision Analysis and Resolution
2-Managed	Basic Project Management	• Requirements Management • Project Planning • Project Monitoring and Control • Supplier Agreement Management • Measurement and Analysis • Process and Product Quality Assurance • Configuration Management
1-Initial		

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Benefits of use of CMMI assessment

- **CMMI acts as a roadmap for process improvement activities.**
- **It provides criteria for reviews and appraisals.**
- **It provides a reference point to establish present state of processes.**
- **CMMI addresses practices that are the framework for process improvement.**
- **CMMI is not prescriptive; it does not tell an organization how to improve.**

SQA PLAN

- Introduction
  - plans for SQA activities must be documented in the Software Quality Assurance Plan (SQAP) (SQA02)
  - the first issue of the SQAP must be prepared by the end of the UR (user requirement) review
  - outline the SQA activities for the whole project and define in detail SR (s/w requirement) phase SQA activities
  - sections of the SQAP must be produced for the AD (architectural design), DD (detailed design), and TR (testing review) phases, to cover in detail all the SQA activities that will take place in those phases

- the size and content of the SQAP should reflect the complexity of the project

- Style
  - the SQAP should be plain and concise
  - the document should be clear, consistent and modifiable
  - the author of SQAP should assume familiarity with the purpose of the software, and not repeat information that is explained in other documents

- Responsibility
  - a SQAP must be produced by each contractor developing software
  - review of the SQAPs produced by each contractor is part of the supplier control activity
  - the SQAP should be produced by SQA staff – should be reviewed by those to whom the SQA personnel report

- Medium
  - it is usually assumed that the SQAP is a paper document
  - no reason why the SQAP should not be distributed electronically to participants with the necessary equipment

- Content
  - the SQAP is divided into 4 sections, one for each development phase.
  - Software Quality Assurance Plan for the SR phase (SQAP/SR)
  - Software Quality Assurance Plan for the Ad phase (SQAP/AD)
  - Software Quality Assurance Plan for the DD phase (SQAP/DD)
  - Software Quality Assurance Plan for the TR phase (SQAP/TR)
  - Software Engineering Standards commends the following table of content for each section of the SQAP