Software Quality Assurance Planning

Software Quality Assurance

- Used to Monitor and Improve the Software Development Process
- Making Sure That Standards and Procedures are Followed
- Ensures that Problems are Found and Dealt with
- Orientated to ‘Prevention’

Software Quality Assurance

- Planned and Systematic Approach to the Evaluation of the Quality of and Adherence to:
  - Software Product Standards
  - Processes
  - Procedures
- Assures that Standards and Procedures are Established and Followed throughout the Software Development Process
- IEEE ISO 9000 Certified

Content of SQA Plan

- The IEEE Standards for SQA Plans states that the plan should contain the following sections:
- Purpose
- Reference documents
- Management
- Documentation
- Standards, practices and conventions
- Reviews and Audits

Content of SQA Plan

- Configuration Management
- Problem reporting and corrective action
- Tools, techniques and methodologies
- Code control
- Media control
- Supplier control
- Records collection, maintenance and retention

Purpose

- This states the specific purpose and scope of the SQA plan. It names the software product that it covers and describe its use.

Referenced documents

- A complete list of the documents referenced in the plan.

Management

- IEEE standard lays down three aspects that should be covered in this section of the Quality Assurance Plan:
- Organization
- Tasks
- Responsibilities

Organization

- It is about the project organization, roles of team members, their hierarchy etc. It is important that head of SQA function in the organization has authority to be able to perform independent verification that the processes are adhered to.

Tasks

- The sequence of tasks, which need to be performed, includes:
  - Preparing preliminary software requirements specification; perhaps as a part of the development of a system involving hardware and software
  - Preparation of a software configuration plan, a software quality assurance plan and a software development plan which may or may not include the other two documents
  - Software requirements review
  - Software design review
  - Preparation of software requirements specification
  - Conducting review of software requirements specification document

Tasks

- Preparing a software test plan
- Preparing a top-level software design
- Preparing a draft support documentation, e.g. user manuals.
- Top level software design review
- Preparing software test description
- Production of a detailed software design
- Detailed software design review
- Production of software test procedures
- Production of source code and object code for the code units

Tasks

- Testing of code units
- Integration of software modules/units
- Testing of integrated software units
- System integration and systems integration testing
- Acceptance Testing

Responsibilities

- The quality manager will:
- Define the responsibilities of quality personnel in the form of quality assurance procedures applicable to the project
- Agree to the quality plan with the project manager.
- Approve the plan of audits for the project which are to be carried out by quality personnel
- Resolve any disagreement between the project manager and quality personnel on matters relating to quality
- Review of activities performed by project personnel to ensure that the requirements of the quality plan and quality procedure are being satisfied
- Review the contents of software standards, engineering codes of practices and quality procedures for adequacy and efficiency

Responsibilities

- Quality personnel will:
- Carry out planned internal audits of the project to assess compliance with quality objectives.
- Agree on corrective action with the project manager for any discrepancies, non-conformities found and ensure that corrective action is taken
- Evaluate defect trends and take appropriate action
- Refer any unresolved discrepancies to the quality manager for resolution

Documentation

- This section will normally include the following:
- Software Requirements Specification (SRS)
- Software Design Description
- Software Verification Plan
- Software verification report
- References to Software standards and procedures mentioned and defined as in the Quality Manual
- Configuration Management Plan
- Software Quality Objectives

Standards, Practices and Conventions

- This section of the SQA plan should contain at a minimum, the following:
- Documentation standards
- Logic structure standards
- Coding standards

Reviews and Audits

- This section of the SQA plan will state which technical and managerial reviews will be undertaken and how they will be carried out. The ANSI standards suggests that the following would be the minimum set of reviews:
- **Software Requirements Specification Review:** this review is held to approve the document defining the software requirements specification and it aims to check the adequacy of the requirements.

Reviews and Audits

- **Preliminary Design Review:** The purpose of this review is to approve formally, the software top-level design document. These will be included ensuring that:
  - The design was produced in accordance with the development standards chosen to implement the selected methodology
  - All the necessary tasks were undertaken (Joint Application Review, Proof of Concepts etc)
  - The top-level design is an adequate basis for future work
  - The top-level design, when implemented, will satisfy any sizing and timing constraints
  - The software top-level design document was produced in accordance with the organization's standard and is internally consistent, understandable, complete and appropriately detailed

Reviews and Audits

- **Critical Design Review:** The purpose of this review is to approve the software detailed design document as a basis for further development work. These will be included ensuring that:
  - The design was undertaken in accordance with the organization's standards and is technically feasible
  - All the necessary tasks have been undertaken (Application architecture, entity relationship diagrams, entity history diagram, state transition diagrams etc)
  - The detailed design was internally consistent, understandable, complete and appropriately detailed
  - Traceability is maintained through the top-level design to the software requirements specification
  - Test cases for unit test and integration test have been prepared as part of the design and have been checked for consistency with the organization's standards

Reviews and Audits

- **Software Verification Review**: The purpose of this review if to approve the test plan. It is an evaluation of the completeness of the methods described.
- **Functional Audit:** This is held to verify that all the requirements in the software requirements specification have been met.
- **Physical Audit:** This is held to verify that the software and its documentation are internally consistent prior to delivery to the user.
- **In-Process Audits:** In-process audits of a sample design are held to verify the consistency of the design.
- **Management Review:** It is important that the execution of the quality plan is evaluated and there will be one or more reviews of this.

Configuration Management

- We'll undertake detailed discussion about this in a separate chapter dedicated to this topic. This section of the SQA plan will cover configuration identification, configuration control, configuration status accounting, and configuration auditing.

Problem Reporting and Corrective Action

- This section of the SQA plan will describe the system, which ensures that software problems are documented and resolved. It should be a closed-loop system. All the problems should be reported at appropriate level, acted upon and resolved.

Tools, Techniques and Methodologies

- This section of the SQA plan should identify the special software tools, techniques and methodologies employed that support quality assurance, state their purposes and describe their uses.

Code Control

- In a software project, this is likely to be implemented in conjunction with the library function.
- The library receives and maintains copies of all software tools and documentation.
- The library will issue all material and ensure that the most recent authorized version is available.
- Access to code files is controlled to ensure that no unauthorized use or modification takes place.

Media Control and Back Up

- This section of the SQA plan will describe how the media are to be protected from unauthorized access or damage. Security threats to a software project come from the following environment factors:
  - Fire Damage
  - Water Damage
  - Energy Variations
  - Unauthorized Intrusion
  - Viruses and Worms
  - Misuse of Software, Data and Services

Supplier Control

- This has relevance while outsourcing some components of a software project. It is important that externally developed software is of the appropriate quality.

Records Collection, maintenance and Retention

- Any successful project will undergo substantial maintenance over a long period.
- It is important to ensure that all the documentation necessary to undertaken this quickly, efficiently and cheaply is going to be available when required.

ISO 9001:2000 Clause 4.2.3 Control of Documents

A documented procedure shall be established to define the controls needed

a) to approve documents for adequacy prior to issue,
b) to review and update as necessary and re-approve documents,
c) to ensure that changes and the current revision status of documents are identified
d) to ensure that relevant versions of applicable documents are available at points of use,
e) to ensure that documents remain legible and readily identifiable,
f) to ensure that documents of external origin are identified and their distribution controlled, and
g) to prevent the unintended use of obsolete documents, and to apply suitable identification to them if they are retained for any purpose

ISO 9001:2000 Clause 4.2.4 Control of Records

Records shall be established and maintained to provide evidence of conformity to requirements and of the effective operation of the quality management system. Records shall be legible, readily identifiable and retrievable. A documented procedure shall be established to define the controls need for the identification, storage, protection, retrieval, retention time and disposition of records.

Illustration: Quality Assurance Plan of XYZ Project

Quality Objectives

XYZ Project will comply with the agreed quality objectives as given by the QMS. The quality objectives for the project is as follows:

Reviews

Project progress will be reviewed in every week and monthly status report as mentioned in the "Status Reporting section of this document.

Peer Review will be planned & scheduled for each internal or external deliverable as defined in the project plan or in Statement Of Work. Review records will also be maintained as per the approved template.

Test Plan

Test plan for the project is in the document called "Test Plan for XYZ Project". Please refer to the document ID D1003. Since deliverables of each service are documented in Statement Of Work, test plan will be reviewed and updated as and when any new Statement Of Work is being executed or any new service is being started.

Standards & Guidelines

Coding & other project's Standard/Guidelines are documented and kept in the specific area in the controlled space as mentioned in Configuration Management plan. Standard & Guidelines will have to be approved by the Project Manager.

Process Adherence

Project will be executed to comply with the process as defined in this project plan, Contract, Statement Of Work or Standard & Guidelines as mentioned above. It is possible that certain processes (as defined in Quality Management System) are tailored as per the requirement of XYZ project. Adherence to the defined processes should be reviewed in various project reviews and audits.

Document Control

Documents are being categorized in two categories Master Documents & Other Documents. List of all the Master Documents will be kept along with the Master Documents in the specific controlled area as mentioned in Configuration Management Plan. Each Master Document will be issued a running Document ID. Master Documents will be modified as per the process mentioned later in this document while other Documents will be modified as other Configuration Items of this project.

SQA: Organization Level Initiatives

- **Process Management:** Organization level activity is like a close feedback loop. Its aim is to:

- Define a standard software process: You need a method to define the procedure, to develop and maintain process documentation and a usable set of software process assets.
- Ensure that each project uses an appropriate version of the standard process that has been tailored to its individual needs. For this “tailoring guidelines” need to be developed.
- Use the results from projects to improve the standard process. For this a metrics program needs to be established.

SQA: Organization Level Initiatives

- **Standard Process Definition:** Organizations need to establish, document and maintain a standard software process. The process for process definition should typically address:

- Activities in Process Definition
  - Develop and maintain organization's software process.
  - Identify organization's software process
  - Define/Change organization's software process
  - Document the process
  - Review and approve the process
  - Release, distribution and retirement of QMS document

SQA: Organization Level Initiatives

- Identification and documentation of software life cycles, methods and tools
- Develop and maintain tailoring guidelines for projects
- Guidelines for writing a process document
- Guidelines for creating a release notice for announcing the new/modified processes
- Guidelines for reviewing new process documents
- Guidelines on process release

SQA: Organization Level Initiatives

- Each project has its own approved life cycle that defines:
  - Required procedures, practices, methods and technologies
  - Applicable process and product standards
  - Responsibilities, authorities and staff interrelationships
  - Required tools and resources
  - Process dependencies and interfaces
  - Process outputs and completion criteria
  - Product and process measurements to be collected.

SQA: Organization Level Initiatives

- **Software Process Measurements:** It is said that you cannot "improve" something that you cannot "measure". Therefore it is essential to take measurements of the performance of the standard software process, as applied to individual projects.
- In developing a metrics program, the following issues need to be resolved:
  - "What" should be measured?
  - "Why" should be measured?
  - "How" it should be measured?

SQA: Organization Level Initiatives

- "Who" should measure it?
- "When" and "Where" in the process it should be measured

➢ Most important thing is to have a linkage of these measurements to organization's ability to meet the requirements of its customers.

➢ The selected metrics should therefore:

- Be linked to real customer requirements
- Support the overall goals and objectives of the measurement program
- Support predefined analysis activities
- Be consistent across all projects
- Cover the entire life cycle, including support and maintenance

SQA: Organization Level Initiatives

- Example of specific measurements that can be used are:

- Estimated versus actual size, cost and schedule date.
- Quality measurements as defined in the quality plan (Productivity, effort, defect removal efficiency etc).
- Number and severity of defects in requirements, design and code
- Number and cost of changes to approved requirements and design specifications
- Number and turnaround time of customer requests and bug reports (customer reported bugs)

SQA: Organization Level Initiatives

- **Defect Prevention:** It is concerned with ensuring that sources of defects that are inherent in the software process, or of defects that occur repeatedly are identified and eliminated. The defects are identified from following inputs:
  - Process wind up reports
  - Organizational metrics analysis
  - Audit & Assessment reports
  - Other organizational level meetings

SQA: Organization Level Initiatives

- At the project level, it is essential to include defect prevention activities in the project development plan and schedule.
- Defects can be categorized by cause, such as inadequate training, breakdown of communications, oversight of important details, or manual errors.
- The activity of finding out the causes for defects and classification of defects is known as casual analysis.

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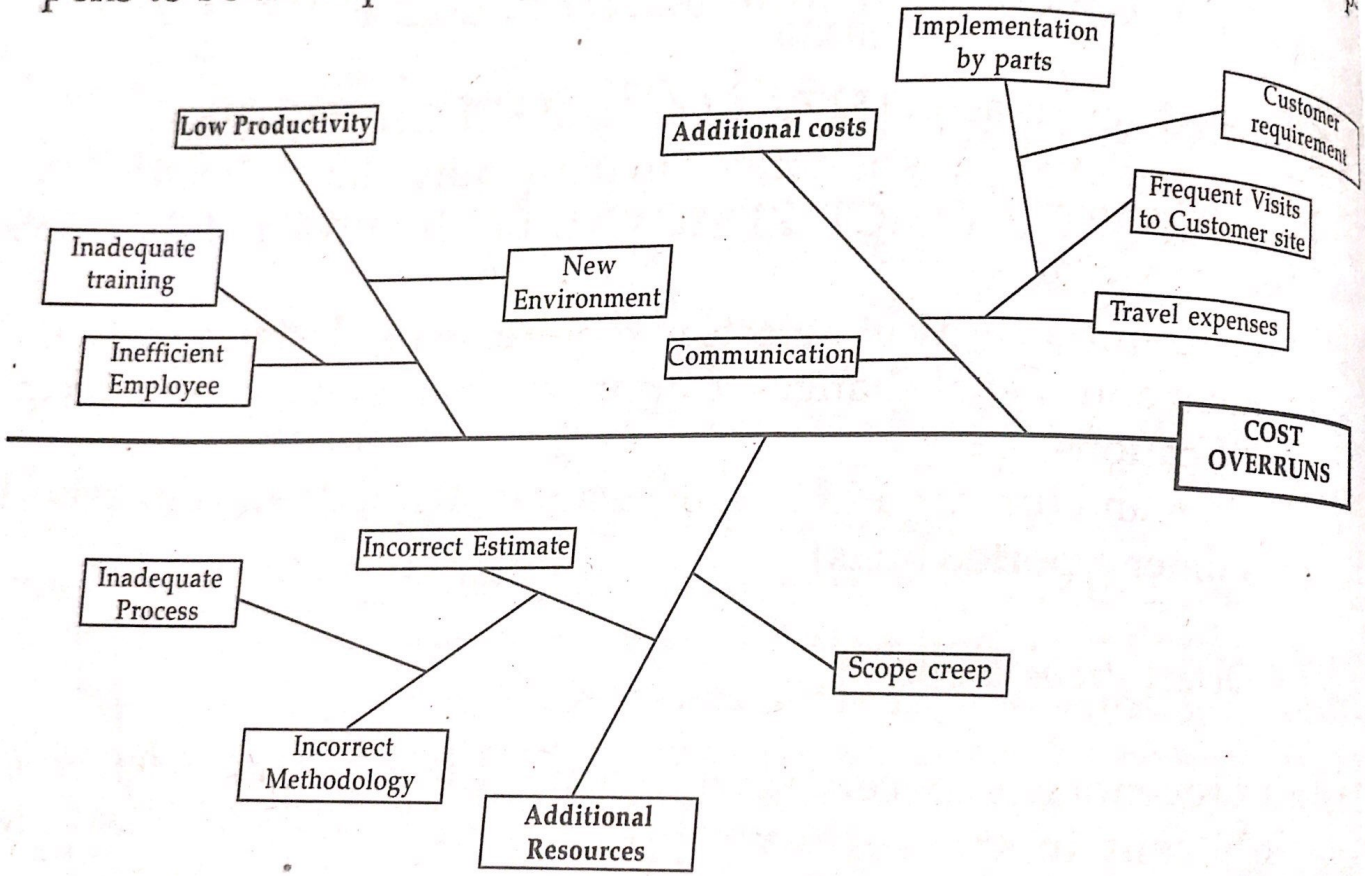
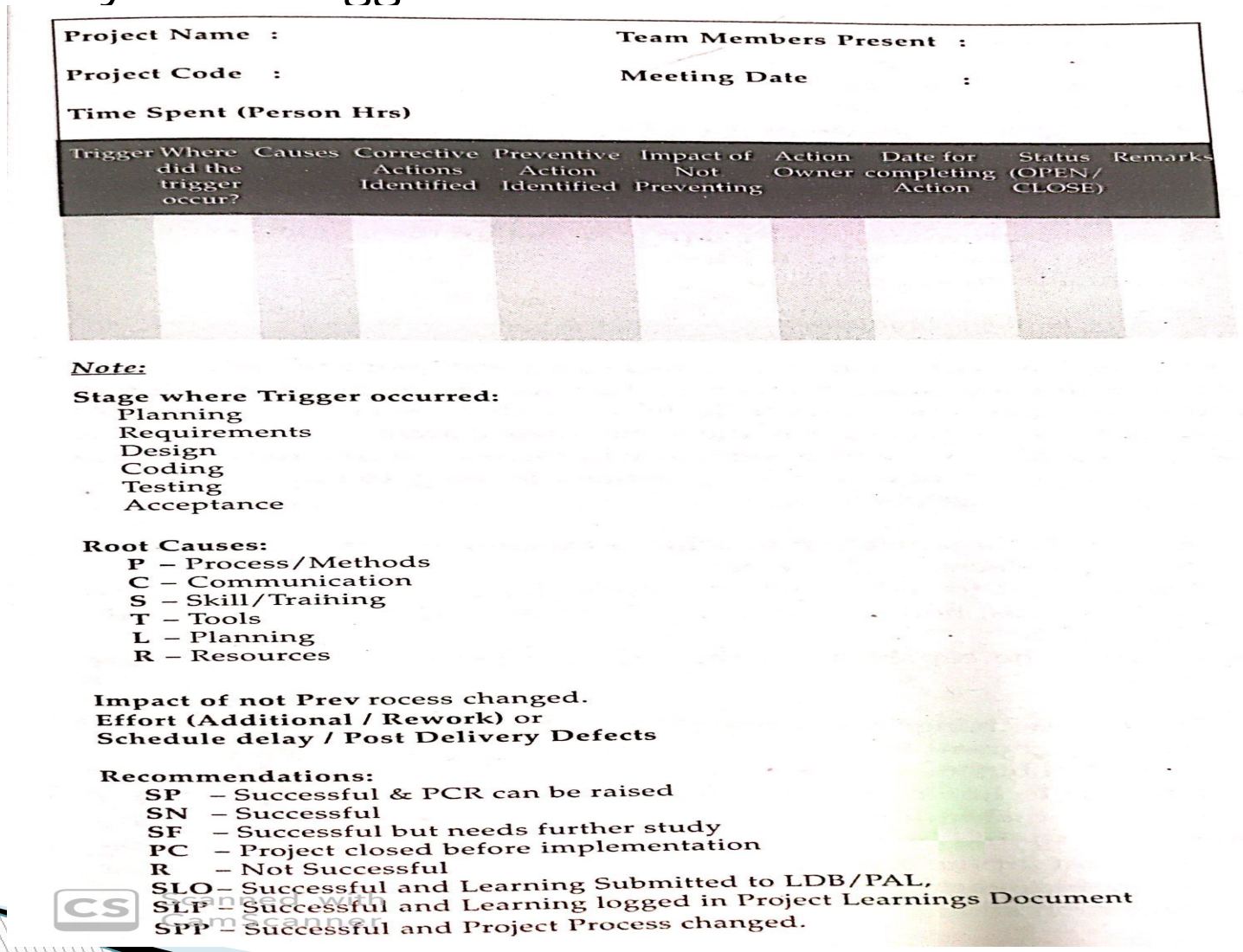


Figure 2: Root Cause Analysis (An Example)

- Format for maintaining a record of Root Cause Analysis is suggested below:



Project Name : **Team Members Present :**

Project Code : **Meeting Date :**

Time Spent (Person Hrs)

Trigger	Where did the trigger occur?	Causes	Corrective Actions Identified	Preventive Action Identified	Impact of Not Preventing	Action Owner	Date for completing Action	Status (OPEN/ CLOSE)	Remarks

Note:

Stage where Trigger occurred:
Planning
Requirements
Design
Coding
Testing
Acceptance

Root Causes:
P – Process/Methods
C – Communication
S – Skill/Training
T – Tools
L – Planning
R – Resources

Impact of not Prev rocess changed.
Effort (Additional / Rework) or
Schedule delay / Post Delivery Defects

Recommendations:
SP – Successful & PCR can be raised
SN – Successful
SF – Successful but needs further study
PC – Project closed before implementation
R – Not Successful
SLO – Successful and Learning Submitted to LDB/PAL,
SLP – Successful and Learning logged in Project Learnings Document
SPP – Successful and Project Process changed.

SQA: Organization Level Initiatives

- Proposed defect prevention actions such as the following:
  - Description of the defect
  - Description of the cause
  - Category of the cause
  - Stage where the defect was identified
  - Description of the proposed action
  - Whether the proposed action is feasible or not
  - Person responsible for implementing the action

SQA: Organization Level Initiatives

- Date by which the action is to be completed
- Description of the areas affected by the corrective action
- Individuals who are to be kept informed of the action's status
- Date of the next status review
- Rationale for key decision

- **Technology innovation:** It will focus on technology changes or introduction of new technologies that are likely to improve the capability of it. These changes:
- Enable the organization to achieve exacting quality standards resulting in decreases in defects

SQA: Organization Level Initiatives

- Empower it to reduce process cycle times and increase process effectiveness, both of which would in turn improve productivity and quality
- Improve the capability of the organization's standard software processes

Technology Pilot Results Summary

Technology piloted
Project Name
Expected Benefits
Cost
Platform on which evaluated
Evaluation period
Modules evaluated
Number of people involved in evaluation
Technology installation effort (person hours)
Training duration (hours/days)
Learning curve (days/months)
Average effort required to use technology during steady state
Benefits (preferably quantitative in terms of schedule, effort, etc.)
Issues/Problems Faced
Lessons Learned
Risks/Uncertainties in results
Recommendations for wider usage in the organization
Additional Comments

Technology Pilot Results Summary

SQA: Organization Level Initiatives

- **Process Change Management:** Sources of inputs for process change are:
  - Findings and recommendations from Audits and Assessments
  - Lessons learnt from monitoring process activities
  - Change proposals from project staff and managers
  - Analyzed and interpreted processes and product measurement data
- The format for Process Change request should include the following:
- Requester's Name
- Requester's contact no
- Ref to process in the Quality Management system for which change is requested
- Description of change requested
- Justification for the change suggested