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SOFTWARE PROCESS AND PRODUCT QUALITY

ASSURANCE IN IT ORGANIZATIONS

Mr. S. Manivannan
Research Scholar
Anna University of Technology, Coimbatore
E-mail: smanivannan2003@yahoo.com

Dr. S. Balasubramanian
Research Scholar
Anna University of Technology, Coimbatore
E-mail: s_balasubramanian@rediffmail.com

ABSTRACT:

The objective of Process and Product Quality Assurance (PPQA) is to objectively evaluate the processes and associated work-products and provide management with the details of current strength and weakness of the process and work products, which aid for the continual process improvement. The purpose of Process and Product Quality Assurance is to provide staff and management with objective insight into processes and associated work products

INTRODUCTION TO PPQA

The Process and Product Quality Assurance process area involves the following:

- Objectively evaluating performed processes, work products, and services against the applicable process descriptions, standards, and procedures
- Identifying and documenting noncompliance issues
- Providing feedback to project staff and managers on the results of quality assurance activities
- Ensuring that non compliance issues are addressed.

The Process and Product Quality Assurance process area supports the delivery of high-quality products and services by providing the project staff and managers at all

levels with appropriate visibility into, and feedback on, processes and associated work products throughout the life of the project.

The practices in the Process and Product Quality Assurance process area ensure that planned processes are implemented, while the practices in the Verification process area ensure that the specified requirements are satisfied. These two process areas may on occasion address the same work product but from different perspectives. Projects should take advantage of the overlap in order to minimize duplication of effort while taking care to maintain the separate perspectives.

Objectivity in process and product quality assurance evaluations is critical to the success of the project. (See the definition of "objectively evaluate" in the glossary.) Objectivity is achieved by both independence and the use of criteria. A combination of methods providing evaluations against criteria by those not producing the work product is often used. Less formal methods can be used to provide broad day-to-day coverage. More formal methods can be used periodically to assure objectivity.

Examples of ways to perform objective evaluations include the following:

- Formal audits by organizationally separate quality assurance organizations
- Peer reviews which may be performed at various levels of formality
- In-depth review of work at the place it is performed (i.e., desk audits)
- Distributed review and comment of work products

Traditionally, a quality assurance group that is independent of the project provides this objectivity. It may be appropriate in some organizations, however, to implement the process and product quality assurance role without that kind of independence. For example, in an organization with an open, quality-oriented culture, the process and product quality assurance role may be performed, partially or completely, by peers; and the quality assurance function may be embedded in the process. For small organizations, this might be the most feasible approach.

If quality assurance is embedded in the process, several issues must be addressed to ensure objectivity. Everyone performing quality assurance activities should be trained in quality assurance. Those performing quality assurance activities for a work product should be separate from those directly involved in developing or maintaining the work

product. An independent reporting channel to the appropriate level of organizational management must be available so that noncompliance issues can be escalated as necessary.

For example, in implementing peer reviews as an objective evaluation method:

• Members are trained and roles are assigned for people attending the peer reviews.

• A member of the peer review who did not produce this work product is assigned to perform the role of QA.

• Checklists are available to support the QA activity.

• Defects are recorded as part of the peer review report and are tracked and escalated outside the project when necessary.

Quality assurance should begin in the early phases of a project to establish plans, processes, standards, and procedures that will add value to the project and satisfy the requirements of the project and the organizational policies. Those performing quality assurance participate in establishing the plans, processes, standards, and procedures to ensure that they fit the project's needs and that they will be useable for performing quality assurance evaluations. In addition, the specific processes and associated work products that will be evaluated during the project are designated. This designation may be based on sampling or on objective criteria that are consistent with organizational policies and project requirements and needs.

When noncompliance issues are identified, they are first addressed within the project and resolved there if possible. Any noncompliance issues that cannot be resolved within the project are escalated to an appropriate level of management for resolution.

This process area applies primarily to evaluations of the activities and work products of a project, but it also applies to evaluations of nonproject activities and work products such as training activities. For these activities and work products, the term "project" should be appropriately interpreted.

SOFTWARE DEVELOPMENT ACTIVITIES
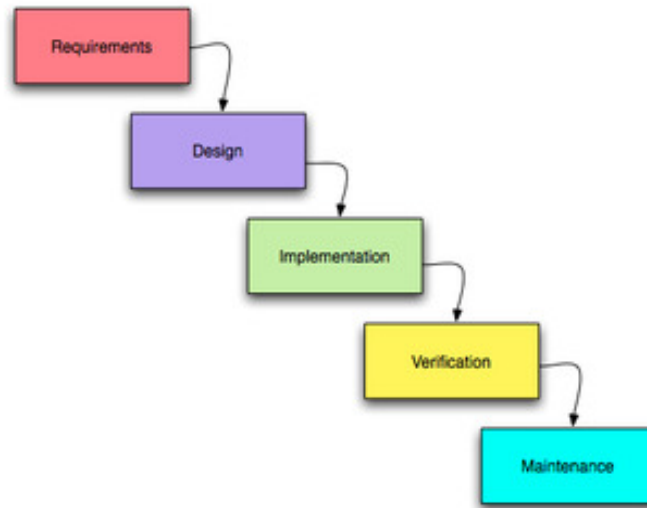
The activities of the software development process represented in the waterfall model.
There are several other models to represent this process.

PLANNING

The important task in creating a software product is extracting the requirements or
requirements analysis. Customers typically have an abstract idea of what they want as an
end result, but not what software should do. Incomplete, ambiguous, or even
contradictory requirements are recognized by skilled and experienced software engineers
at this point. Frequently demonstrating live code may help reduce the risk that the
requirements are incorrect.

Once the general requirements are gleaned from the client, an analysis of the
scope of the development should be determined and clearly stated. This is often called a
scope document.

Certain functionality may be out of scope of the project as a function of cost or as
a result of unclear requirements at the start of development. If the development is done
externally, this document can be considered a legal document so that if there are ever
disputes, any ambiguity of what was promised to the client can be clarified.

DESIGN

Domain Analysis is often the first step in attempting to design a new piece of software, whether it be an addition to an existing software, a new application, a new subsystem or a whole new system. Assuming that the developers (including the analysts) are not sufficiently knowledgeable in the subject area of the new software, the first task is to investigate the so-called "domain" of the software. The more knowledgeable they are about the domain already, the less work required. Another objective of this work is to make the analysts, who will later try to elicit and gather the requirements from the area experts, speak with them in the domain's own terminology, facilitating a better understanding of what is being said by these experts. If the analyst does not use the proper terminology it is likely that they will not be taken seriously, thus this phase is an important prelude to extracting and gathering the requirements. If an analyst hasn't done the appropriate work confusion may ensue: "I know you believe you understood what you think I said, but I am not sure you realize what you heard is not what I meant."[1]

ARCHITECTURE

The architecture of a software system or software architecture refers to an abstract representation of that system. Architecture is concerned with making sure the software system will meet the requirements of the product, as well as ensuring that future requirements can be addressed. The architecture step also addresses interfaces between the software system and other software products, as well as the underlying hardware or the host operating system.

IMPLEMENTATION, TESTING AND DOCUMENTING

Implementation is the part of the process where software engineers actually program the code for the project.

Software testing is an integral and important part of the software development process. This part of the process ensures that bugs are recognized as early as possible.

Documenting the internal design of software for the purpose of future maintenance and enhancement is done throughout development. This may also include the authoring of an API, be it external or internal.

DEPLOYMENT AND MAINTENANCE

Deployment starts after the code is appropriately tested, is approved for release and sold or otherwise distributed into a production environment.

Software Training and Support is important because a large percentage of software projects fail because the developers fail to realize that it doesn't matter how much time and planning a development team puts into creating software if nobody in an organization ends up using it. People are often resistant to change and avoid venturing into an unfamiliar area, so as a part of the deployment phase, it is very important to have training classes for new clients of your software.

PPQA PROCEDURE

The CMMI Requirements Development process area describes three types of requirements:-

Customer requirements, product requirements, and product-component requirements.

SQA role to observe (audit) that documented standards, processes, and procedures are followed.

SQA would also establish software metrics in order to measure the effectiveness of this process.

A common metric for measuring the Requirements process would be the number of errors (found during system testing) that could be traced to inaccurate or ambiguous requirements (note: SQC would perform the actual system testing but SQA would collect the metrics for monitoring and continuous improvement).

SQC role SQC takes an active role with Verification. Verification of the requirements would involve inspection (reading) and looking for clarity and completeness.

SQC would also verify that any documented requirement standards are followed.

Note there is a subtle difference between SQA and SQC with regard to standards, SQC's role is in verifying the output of this process (that is the Requirement document itself) while SQA's role is to make sure the process is followed correctly.

SQA is more of an audit role here, and may sample actual Requirements whereas SQC is involved in the Verification of all Requirements.

The type of requirement need not be just the functional aspect (or customer\user facing requirements) they could also include product and\or component requirements.

Input	Tasks	Output
Project plan	1. Prepare Process and Product Quality Assurance Plan	PPQA Plan
Process assets		**QA status Report**
Organizational	2. Provide necessary process training	PPQA reports
Repository	3. Objectively evaluate the processes	Nonconformance
SQA Checklist	4. Objectively evaluate the work	Reports
Work-Product audit	products and services	
Checklist	5. Prepare evaluation report	
Entry Criteria	6. Initiate post evaluation activities	**Exit Criteria**
Contract	7. Approve the work product and final product for release	Approved PPQA plan
Preliminary project		
plan	8. Provide QA status report to management	
Verification		
Review of PPQA plan		
Review of PQA report and NCR		

ROLES

Abbreviation	Name
PM	Project manager
SM- QA	Sr.Manager – Quality Assurance
QA-R	Quality Assurance Representative
MI	Metrics Incharge

1) PREPARE PROCESS AND PRODUCT QUALITY ASSURANCE PLAN

a. Understand the scope of the project by attending Project kick-off meeting, reviewing Preliminary project plan. (SM-QA)

b. Allocate the QA representative for the project. (SM-QA)

c. Assist the project manager in identifying life cycle model, Project defined processes based on the following. (SM-QA)

- Type and Scope of the project

- Size of the project

- Deliverables produced by the project

- Lessons learned from the Similar completed projects

d. Facilitate the project for the following tasks completion. (QA-R)

- Allocation of resources for the project which includes hardware, software, tools and HR

- Project directory structure creation

- Identification of Configuration controller for the project

- Review of organization repository for incorporation of best practices, lessons learned, reusable components etc

e. Develop Process and product Quality Assurance plan for the project based on project schedule, deliverables produced and project defined processes by mentioning the following. (QA-R)

- Processes to be evaluated

- Work-products to be evaluated

- Criteria for evaluation

- Evaluation method

- Evaluation Schedule

- Responsibility of evaluation

f. Get process and product quality assurance plan reviewed by the PM (QA-R)

g. Get approval for the process and Product quality assurance plan from SM-QA (QA-R)]

2. PROVIDE NECESSARY PROCESS TRAINING.

- Identify the process training needs for the project team based on employee role / employee's training completion records (PM / QA-R)
- Conduct necessary process training programs. (QA-R)
- Collect feedback from the participants for process improvement / training function improvement. (QA-R)
- Update employee's training completion records. (QA-R)

3   OBJECTIVELY EVALUATE THE PROCESSES

- Select the work product to be evaluated based on the PPQA plan. (QA-R)
- Objectively evaluate the processes that produced the work product based on the criteria for evaluation [Existence of work product does not provide assurance that the specified process was followed to produce the output. Execution of process leaves auditable quality records like review comments, MOM, checklist which needs to be evaluated] (QA-R)
- Collect best practices and lessons learned that could improve the process and include them in the organizational repository (QA-R)
- Identify the non-conformances found during evaluation (QA-R)

4. OBJECTIVELY EVALUATE THE WORK PRODUCTS AND SERVICES

- Select the work product to be evaluated based on the PPQA plan (QA-R)
- Objectively evaluate the work product (including intermediate and final) to ensure conformance to standards and requirements as set forth by the project manager and the customer (QA-R)
- Identify the non-conformances found during evaluation [QA-R]

5. PREPARE EVALUATION REPORT

a. Prepare Non-Conformance Report based on the Non Conformities observed during evaluation of process and work product. (QA-R)

b. Classify the NC as Major or minor based on the following guidelines (QA)

- **Major:** if the severity of the NC leads to a change in QMS or project defined process.

- **Minor**: if the severity of the NC leads to document control and typographical changes in the project documents

c. Collect evaluation findings (observations, good practices and Non-Conformities) and prepare evaluation report. (QA-R)

d. Circulate the evaluation report to all relevant stake holders (QA-R)

e. Follow-up on for corrective action and track the NCs to closure (QA-R)

6. INITIATE POST EVALUATION ACTIVITIES.

- Consolidate the NCs and create NC database (QA-R)

- Analyze the NC data base and prepare NC trend charts (MI)

- Based on the NC analysis identify the process improvement opportunities and include them in Process Action Plan (SM-QA)

- Consolidate the good practices captured and contribute it to organizational repository (QA-R)

- Identify the good practices to be incorporated into QMS and include them in process action plan (SM-QA)

- Escalate open issues to the SM-QA. (QA-R)

7. APPROVE THE WORK PRODUCT / FINAL PRODUCT FOR RELEASE

- Ensure that all processes are complied with. (QA-R)

- In case of open NC/ finding, obtain the approval of SBU head for deviation.

- Ensure that there is specific action plan to resolve it. (SM-QA / QA-R)

- Approve the work product / final product for release (SM-QA / QA-R)

8. Provide the QA Status Report to Management

- Collect Project status details from all the projects (SM-QA/ QA-R)

- Analyze the gathered project status details and plan for mitigation / project coaching for the risks identified in the project (SM-QA / QA-R)

- Prepare QA status report, by consolidating details gathered from the projects on milestone review and audits. (SM-QA)

- Appraise the management on the QA status (SM-QA)

- Where issues are un-resolved at the SM-QA level, escalate to the Management through the QA status report. (SM-QA)

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