Analysis of Process and Product Quality Assurance

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Abstract: The present paper defines standardized minimum requirements on activities, responsibilities, interfaces and input, as well as output documents for the execution of the process and product quality assurance (PPQA). The PPQA supports the delivery of high quality products and services by providing the staff and managers at all levels with appropriate, objective insight into, and feedback on, processes performed and associated work products throughout the life of the project. The PPQA aims at objectively evaluating processes and associated work products. The applied practices shall ensure that processes and work products are being implemented as planned. In addition feedback is collected and weak points in the process are identified and adequately communicated to local management.

Key-Words: process, project, work product, quality, planning, management, organizational, audits

1 Introduction

The process and product quality assurance (PPQA) 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 [1].

The PPQA process area involves the following [2]:

- 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 noncompliance issues are addressed.

The practices in the PPQA 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 [2].

Process quality is the guarantee for good product quality [3]. Product quality is a basic driver of buyer behavior across a wide range of categories in both goods and services markets. The task of determining product quality can be a challenging one for many consumers. Often, a large number of variables contribute to a product's quality. For example, for consumer durables, factors such as performance, reliability, and serviceability may affect consumer experiences with the product [4].

Quality is a lengthy process that cannot be achieved overnight. The best way to achieve continuous improvement in quality in any manufacturing organization is to develop a quality path and the persons responsible for quality implementation should religiously follow the defined quality route. The quality route is sub-divided into four steps [5]:

- the first step towards quality implementation is to “define the quality requirements”;
- the second step is “planning” - how to achieve the desired quality. It is essential to review the outcome of the planning made before starting the execution of work. The review is done by a

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group of expert professionals within the organization headed by the quality assurance engineer. The review is, indeed, essential to eliminate any flaw in the planning;
- the third step of the activities starts with the "execution of work" as per guidelines of quality planning;
- the fourth and concluding phase of the activity start with the verifications of quality aspects of the outcome of work done vis-a-vis planning made during second phase. The purpose of verification is to identify deviations from the "the job planned and actually achieved." Further the cause of deviation is reviewed and eliminated through nonconformance analysis.

Quality assurance is practiced by users to control the quality of the product provided to a user at a specified acceptable level. In contrast to quality assurance, quality control is practiced by manufacturers to control the quality of production at a specified acceptable level. Although quality assurance and quality control practices can be considered as independent activities, their goals are essentially the same: to ensure that the consumer receives quality equipment on time for the contracted price [6].

PPQA is often misunderstood or purposefully equated to testing. It is important to distinguish between "quality control" and "quality assurance." Quality control evaluates or checks the quality of the products and life-cycle work products. Quality control functions or activities help to determine if the product or work product is within defined tolerances and of acceptable quality. Tools and techniques used for quality control include peer reviews such as inspections or structured walkthroughs and the different levels of testing [2, 7].

Quality assurance activities and involvement should begin in the early phases of a project to facilitate the effective establishment of plans, processes, standards, and procedures that will [2, 7]:
- add value to the project;
- satisfy the requirements of the project and organizational policies.

Quality assurance representatives should participate in the establishment of those plans, processes, standards, and procedures to ensure they will fit or can be tailored to fit the project's needs. It is also important that the project's documents can be audited or objectively evaluated [2, 7].

Defects identified through the performance PPQA process area activities and audits after an item has completed peer review are a rich source for potential defect prevention activities. If the peer review process has been effective, then the amount of defects in the product reviewed should be little to none. If there are significant defects identified, then the result of the PPQA audit of the product must then point to a very inefficient peer review process [7].

From a process improvement point of view, one can view PPQA as either a project management function or as a quality management function depending on the organization's culture and orientation to project management or quality management and still make it work. The purpose of PPQA is to provide staff and management with objective insight into both processes and associated work products. It is important that objective insight is to be provided to all levels of management including project management, middle management, and senior management to ensure that they understand both how the processes are being implemented on the projects and whether they are helping the project members to produce the desired product quality or not [2].

The total quality management concept represents a fundamental change in the definition and treatment of quality in product development [8]. Critical process is the decisive process for the successful implementation of the product quality, as well as the critical point of the quality surveillance during production [9].

2 Process description

2.1 Process roles and stakeholders

The following roles are involved:
- project staff or alternatively staff of the organizational unit (employees) – interviewed during process and product audits, informed about

audit results, performs defined corrective actions to resolve non-compliances, can suggest process improvements;
- project leader, alternatively head of the organizational unit – interviewed during process and product audits, informed about results of process and product quality assurance (PPQA) audits, responsible for the definition of corrective actions and for assigning responsibility for these actions within a project or alternatively organizational unit, can suggest process improvements;
- PPQA auditor – conducts process and work product audits on behalf of the quality manager, if independence from audited organizational unit or project is given, reports to relevant stakeholders (according to site-specific definition) on results and status of the quality assurance activities;
- operative process owner (OPO) – makes improvements in the processes according to issues found after quality assurance activities in cooperation with EPG;
- quality manager – responsible for planning process and product quality assurance activities (PPQA), responsible for the creation and/or maintenance of the site-specific PPQA, instructions and selection criteria, responsible for the project independent PPQA reporting;
- local management – informed about results of PPQA activities.

2.2 Inputs and outputs process, entry and exit criteria

Inputs process includes project data and process data.

Outputs process include complete documentation of PPQA activities (per project or alternatively per organizational unit), quality trend (per project or alternatively per organizational unit), and PPQA report based on PPQA metrics (independent from project/organizational unit).

Entry criteria involve management decision to initialize a project and new business year.

Exit criteria involve the PPQA process is performed during the whole lifetime of a project or on-going activities within an organizational unit. It is finalized with the end of the project or alternatively with the finalization of the activities within an organizational unit.

3 Process activities and flowchart

3.1 Establish PPQA selection criteria, instructions and planning

Entry criteria: new business year, new project.

Inputs: site-specific quality policy, site-specific quality goals, site-specific PPQA instructions and selection criteria, process descriptions, work products, standards.

Activity steps:

- determine or revise PPQA selection criteria regarding listed work products, processes, projects or organizational units to be audited and the criteria how these have to be chosen;
- PPQA activities as a whole (and as determined within the PPQA selection criteria) shall lead to the stipulated and also appropriate coverage of PPQA for the organization. Appropriate means that the selection shall conform to requirements regarding processes, project types, organizational units and persons to be audited;
- determine or revise audit method on the basis of the site-specific PPQA instruction;
- establish an annual planning for PPQA activities concerning project independent (which means organizational or organizational unit scope) PPQA audits;
- establish a project specific planning of PPQA activities for any newly initialized project;

Responsibility: quality manager.

Stakeholder (and participation): PPQA auditors, local management, project leader or alternatively head of the organizational unit, and operative process owner.

Outputs: PPQA selection criteria, site-specific PPQA instructions, project-independent (organizational) PPQA annual planning alternatively project specific PPQA planning.

Exit criteria: PPQA selection criteria and site-specific PPQA instructions are determined, organizational or project specific PPQA planning is established.

3.2. Detailed planning of PPQA

Entry criteria: a PPQA audit is due according to the PPQA annual planning (project independent, i.e. organizational, PPQA audit),

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according to the project specific PPQA planning, and according to customer or project specific quality requirements (ad hoc PPQA audit).

Inputs: list of questions for processes and work products, process descriptions, standards, PPQA selection criteria and instructions, PPQA annual planning or project specific PPQA planning, customer or project specific quality requirements, laws and standards (as relevant for PPQA).

Activity steps:

- detailed planning of the PPQA activities (process and product audits);
- determine evaluation criteria, these are: the standard evaluation criteria for each process (list of questions regarding process descriptions, procedures, process checklists, work product checklists, templates, standards etc.), and project specific criteria based on or defined in customer quality requirements, applicable legislation, or public standards (if existent);
- schedule the PPQA activities and make appointments with the persons to be audited;
- coordinate schedule with project specific or organizational PPQA planning;
- update planning if necessary;

Templates/checklists: list of questions, project specific or alternatively annual PPQA planning.

Responsibility: PPQA auditor.

Stakeholder (and participation): employee to be audited, project leader or head of the organizational unit.

Outputs: updated evaluation criteria (list of questions), audit schedule (including persons to be audited), updated organizational or project specific PPQA planning.

Exit criteria: audit schedule and scope have been determined, all planning documents are up-to-date.

3.3. Objectively evaluate processes, document results

Entry criteria: processes to be audited are being performed, audit schedule and scope have been determined.

Inputs: updated evaluation criteria (list of questions), audit schedule (including persons to be audited), PPQA audit instructions.

Activity steps:

- conduct process audits on performed processes on the basis of the defined criteria and the PPQA audit instructions;
- document each non-compliance;
- analyze causes and impact of the non-compliances together with the involved staff members;
- as a result of the analysis: assign a responsible person for each non-compliance and determine a deadline for correction;
- non-compliances and improvements are tracked with appropriate tools;

Evaluation criteria for processes (List of questions)

Templates/checklists: templates and tools for planning and tracking corrective actions and to collect improvements.

Responsibility: PPQA auditor.

Stakeholder (and participation): audited employee, project leader or head of the organizational unit, local management, and operative process owner.

Outputs: documented non-compliances.

Exit criteria: process evaluation completed as planned which means that all determined evaluation criteria have been considered.

3.4. Objectively evaluate work products, document results

Entry criteria: work products ready for evaluation, audit schedule and scope have been determined.

Inputs: updated evaluation criteria (list of questions), audit schedule (including persons to be audited), PPQA audit instructions.

Activity steps:

- conduct product audits on work products on the basis of the defined criteria and the PPQA audit instructions;
- document each non-compliance;
- analyze causes and impact of the non-compliances together with the involved staff members;

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- as a result of the analysis: assign a responsible person for each non-compliance and determine a deadline for correction;

- non-compliances and improvements are tracked with appropriate tools.

Templates/checklists: evaluation criteria for work products (list of questions), templates and tools for planning and tracking corrective actions and to collect improvements.

Responsibility: PPQA auditor.

Stakeholder (and participation): audited employee, project leader or head of the organizational unit, local management, and operative process owner.

Outputs: documented non-compliances.

Exit criteria: work product evaluation completed as planned which means that all determined evaluation criteria have been considered.

3.5. Communicate quality status

Entry criteria: all relevant stakeholders have been identified.

Inputs: documented non-compliances.

Activity steps:

- document and evaluate audit results and distribute reports to the involved persons (relevant stakeholders);

- non-compliance issues are analyzed to document the quality trend (status and changes of quality level);

- quality trend for projects or alternatively for the organizational unit will be communicated regularly in defined intervals to all relevant stakeholders.

Responsibility: PPQA auditor.

Stakeholder (and participation): audited employee, project leader, alternatively head of the organizational unit, operative process owner PPQA, local management.

Outputs: audit report, project specific or alternatively organizational PPQA reports/quality trends.

Exit criteria: results communicated.

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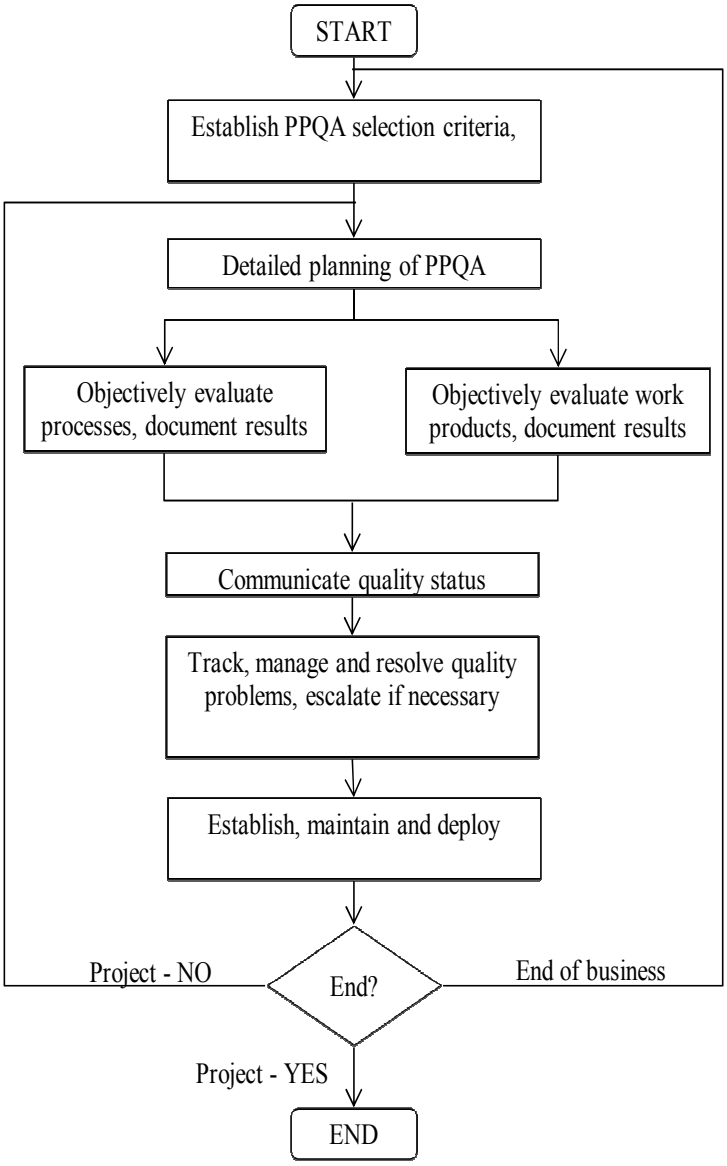

Fig.1 Process and Product Quality Assurance

3.6. Track, manage and resolve quality problems, escalate if necessary

Entry criteria: non-compliances issues for processes or work products have been identified.

Inputs: audit report, documente non-complaisances, panne corrective actions.

Activity steps:

- resolve each non-compliance with the appropriate staff members where possible (project or organizational unit staff);
- tracking and resolving is in the responsibility of the persons designated to conduct the corrective actions;
- escalate non-compliance issues that cannot be resolved within the project or organizational unit or the non-fulfillment of determined corrective actions to the appropriate level of management;
- all non-compliances are tracked to resolution.

Responsibility: PPQA auditor.

Stakeholder (and participation): audited employee, project leader, alternatively head of the organizational unit, operative process owner PPQA, local management.

Outputs: status report of corrective actions.

Exit criteria: identified non-compliances has been resolved by defined corrective actions.

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3.7. Establish, maintain and deploy records of the PPQA

Entry criteria: at least one quality assurance activity has been conducted, and results have been documented and can be reported.

Inputs: audit report, status report of the corrective actions to resolve non-compliances.

Activity steps:

- record and document the status and results of the quality assurance activities;
- regularly revise state and history of the quality assurance activities to ensure that all information concerning quality assurance (corrective actions, results, trends) is up-to-date and has been completely recorded and documented;
- generate and distribute the PPQA report.

Templates/checklists: project independent PPQA report.

Responsibility: quality manager.

Stakeholder (and participation): operative process owner PPQA, local management.

Outputs: project independent PPQA report (including status of the PPQA corrective actions, trends and PPQA metrics).

Exit criteria: project independent PPQA report has been generated and distributed.

4 Conclusion

To ensure objectivity in process and product quality assurance evaluations PPQA auditors have to be independent from the projects or organizational units to be audited. Objectivity is also supported by the use of defined criteria.

To reach the goals of the PPQA, quality assurance activities shall begin in the early phases of a project or in the first phase of the software lifecycle, and is performed simultaneously throughout the whole progression of the project until termination.

All performed processes within software development and the developed work products shall be reviewed regularly according to the PPQA selection criteria in an appropriate rate and at relevant milestones.

The PPQA process itself is also subject to PPQA activities performed by a relative group-wide audit team consisting of PPQA responsible of each site within the scope of the PPQA process. The evaluation of the PPQA process for each site has to be done regularly (at least once a year) and independent from the site to be audited. These PPQA on PPQA audits have to be planned until the end of the preceding year within the site-specific audit planning for organizational processes.

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