Mechanism of Third-Party Quality Assurance

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Computer systems are now so deeply ingrained in society that they form a major social infrastructure. Consequently, computer system problems can have a serious effect on society. At Fujitsu, the urgent tasks of reducing the delay in service release time caused by quality problems and curtailing projects that adversely affect profit must be addressed. Therefore, Fujitsu has devised a mechanism of third-party quality assurance that determines whether sufficient quality is achieved from the early stage of design. This paper describes two mechanisms of third-party assurance based on application auditing: Project Quality Design (PQD) and Application Quality Inspection (APQI).

1. Introduction

Computer system problems can have a serious effect on society. For example, they can prevent people from using the Web system or withdrawing money from a bank. In addition, in system development projects, system problems often necessitate development reworks and cause budget overruns and other troubles. Consequently, such problems can reduce company profits.

Many system problems arise from unclear design in upstream development processes or insufficient verification of whether a system is consistent with design in downstream processes.

At Fujitsu, to handle system quality problems in system development, we have developed and are using a third-party quality assurance mechanism that covers upstream and downstream processes of large-scale projects.

This paper introduces the mechanism of Project Quality Design (PQD), which is a third-party quality assurance audit performed at the system development phase. It also introduces Application Quality Inspection (APQI), which focuses on the application audit.

2. Quality assurance system in system development phase

In the system development phase at Fujitsu, a project audit (PA) meeting is performed by each business group (BG) and a third-party quality assurance mechanism is used for project auditing performed by an organization that is independent of the project.

Figure 1 shows the quality assurance system for the system development phase.

2.1 Mechanism of quality assurance in each BG

Each BG has a PA meeting as a project audit mechanism. Stakeholders in the project, for example, the general manager, project executive, leader, sub-leaders, and salespersons, participate in these meetings and perform an overall check of the delivery date, quality, and cost of the system development.

2.2 Third-party quality assurance mechanism

PQD and APQI are third-party quality as-

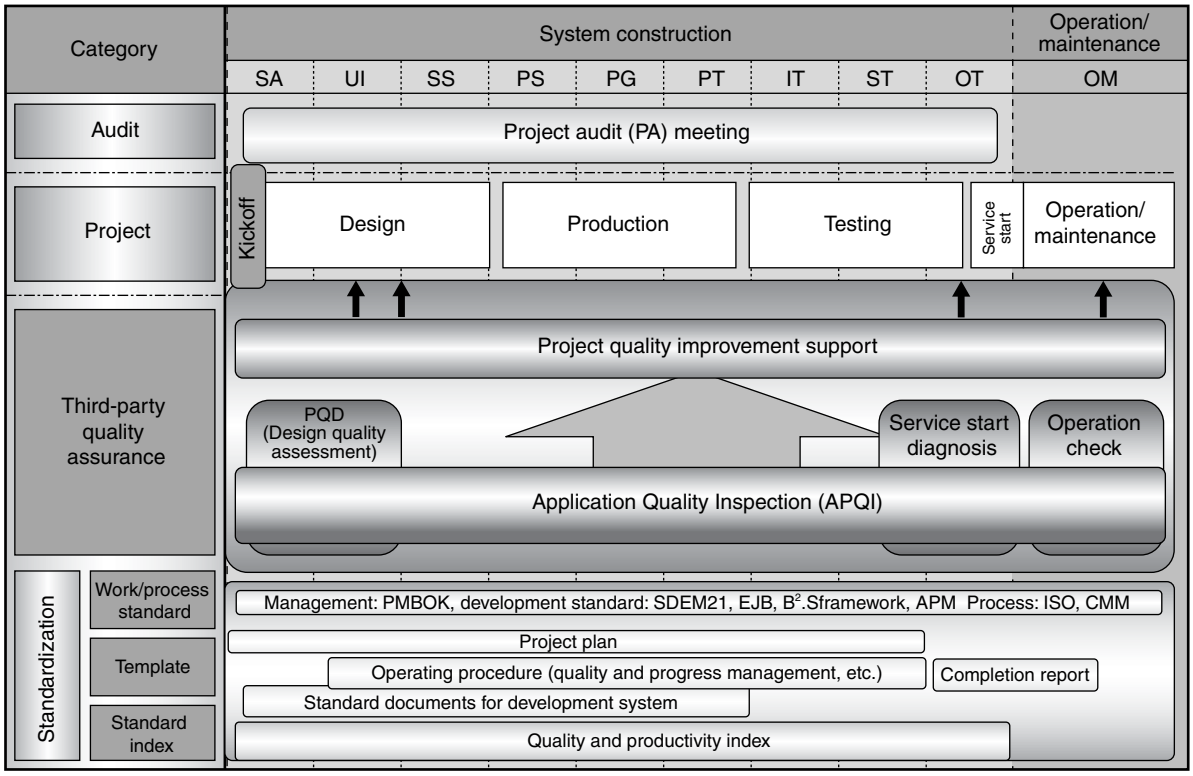

Figure 1
Quality assurance system for system development phase.

surance frameworks for the system development phase. They are performed by an organization that is totally independent of each BG and cover the development process and development products based on checklists.

1) PQD framework

PQD is a quality assurance framework for checking whether work done in the early design phase is sufficient. If PQD indicates there are problems, experts in business and infrastructure fields help the design personnel develop a design specification and the project leader works with these experts to make an action plan and a follow-up plan to protect against risks.

2) APQI framework

APQI is a quality assurance framework focused on applications. It audits all the processes in a system development.

The next sections describe PQD and APQI in more detail.

3. Project Quality Design (PQD)

In PQD, to complete large-scale system development projects without failures, experts in business and infrastructure fields make intensive assessments of the methods, functions, and other details of the basic specifications in upstream processes based on the project policy. As a result, at an early stage, they identify key points for promoting the project. They support the development of design specifications and the development of risk action plans and follow-up plans. The secretariat promoting PQD follows up the tasks (**Figure 2**).

3.1 Target processes for PQD

Many problems in large-scale projects arise from unclear specifications from customers. Therefore, PQD is initiated in the system architectural design (SA) phase and closed as early as possible in the user interface design (UI) phase.

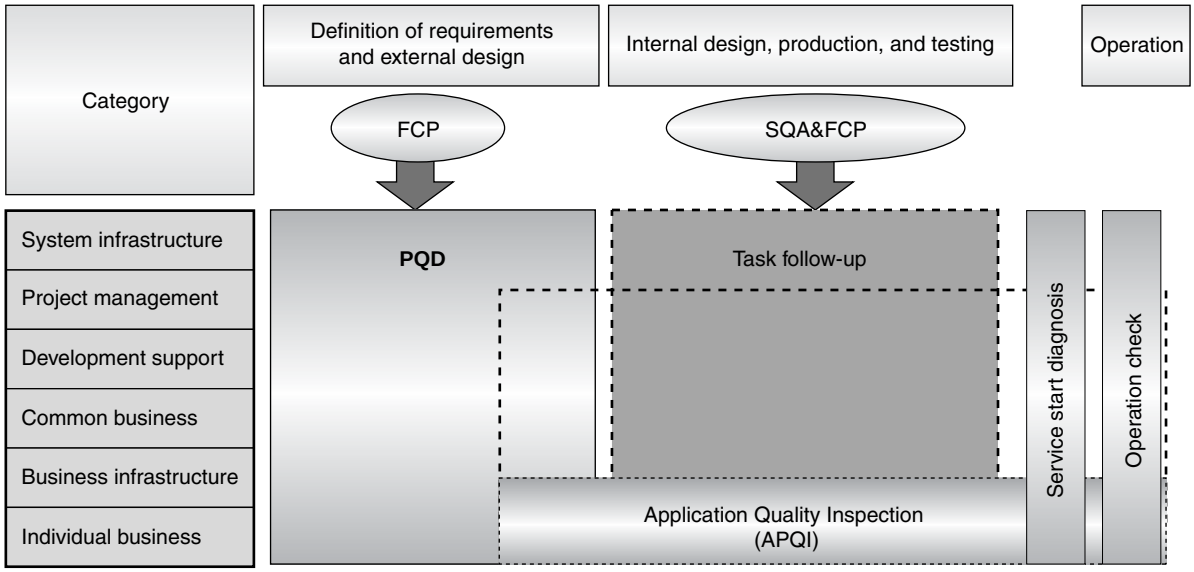

Figure 2
Project Quality Design.

The outputs of the UI phase are checked in the UI phase.

3.2 Procedure of PQD meetings

The main objective of PQD is to clearly determine project policy in the upstream processes of system development. Therefore, in target projects for PQD, the project leader first identifies the project status at the end of the SA phase and then develops and submits PQD documents to the secretariat promoting PQD.

After the secretariat promoting PQD checks the submitted PQD documents, if the experts in business and infrastructure fields determine there is a problem regarding, for example, technology, profit/loss, or system development organization, the secretariat holds a PQD meeting to discuss the following.

1) Overview explanation and questions about the project
2) Explanation of submitted PQD checklist, questions, and discussions of individual problems
3) Development of action items and schedules
4) Detailed consideration of individual problems and how the problems will be solved
5) Identification of the handling status of each individual problem
6) Identification of risks after PQD and future tasks

3.3 Documents of PQD meetings

The documents related to PQD are grouped as follows.

1) PQD documents
- Project facts (current status)
- Risks and handling policies

2) Documents attached to PQD documents
- Detailed schedule
- System configuration diagram (hardware and software)
- Profit briefing document
- Project organization chart (customers and Fujitsu)

3) PQD checklist (for SA and UI phases)
4) Documents attached to the checklist
- Basic specifications and other documents

3.4 Key points of PQD

1) Participation of knowledgeable persons

Internally certified experts called Fujitsu Certified Professionals (FCPs) participate in PQD, discuss problems, and decide on the support required for the project. The FCPs are the following.

- Project managers (FCP-PMs)
- IT architects (FCP-ITAs)
- Application architects (FCP-APAs) and other FCPs

2) PQD checklist

More than 1000 points to be checked are listed by internal knowledgeable persons. The checklist is completed beforehand and verified in PQD meetings.

3) Follow-up of tasks

The current status of the project is assessed by scoring and judging the review result. Then, the improvement status after follow-ups is visualized with radar charts. The PQD secretariat thoroughly follows up until tasks that have arisen are closed.

4) Service start diagnosis

Checks are made to see whether the system is finally operational and whether countermeasures against problems have been implemented.

5) Project planning documents

Risks for promoting projects are identified, and mitigation measures are considered.

4. Application Quality Inspection

In APQI, a third-party audits the business applications and then submits a quality assessment and a list of items that can be improved to increase quality.

4.1 Need for third-party audit throughout entire process

PQD is an audit of business and infrastructure conducted at an early phase of a project. However, for application development, the work breakdown structures (WBSs) within/between processes are all interrelated and more engineers are involved compared with system infrastructure and business infrastructure activities. As a result, errors and omissions often occur in each process. Therefore, to ensure that system development is done properly after the initial design phase, a third-party quality assessment of applications is conducted throughout the entire process.

4.2 Objectives and characteristics of APQI

The objectives of APQI are to 1) perform a quality audit of development deliverables and the development progress status in projects based on a quality checklist in terms of process, product, and project management and 2) prevent quality problems related to business applications from occurring.

An independent third-party (belonging to the Software & Services Technology Unit) audits the quality of the business application and reports the quality assessment and items that need to be improved as the audit results. On the project side, quality can be improved by executing what has been marked for improvement.

4.3 Audit criteria of APQI

The quality audit covers engineering (development method and technology) and project management involved with quality (**Figure 3**).

On the engineering side, the audit covers each product (output) and work process in the design and production processes (in which quality is built in) and in the testing process (in which quality is verified).

On the project management involved with quality side, the audit covers the following six knowledge areas that are directly related to quality in the nine knowledge areas of PMBOK, which is an international standard for project management.

- Integration management
- Scope management
- Time management
- Quality management
- Human resource management
- Communication management

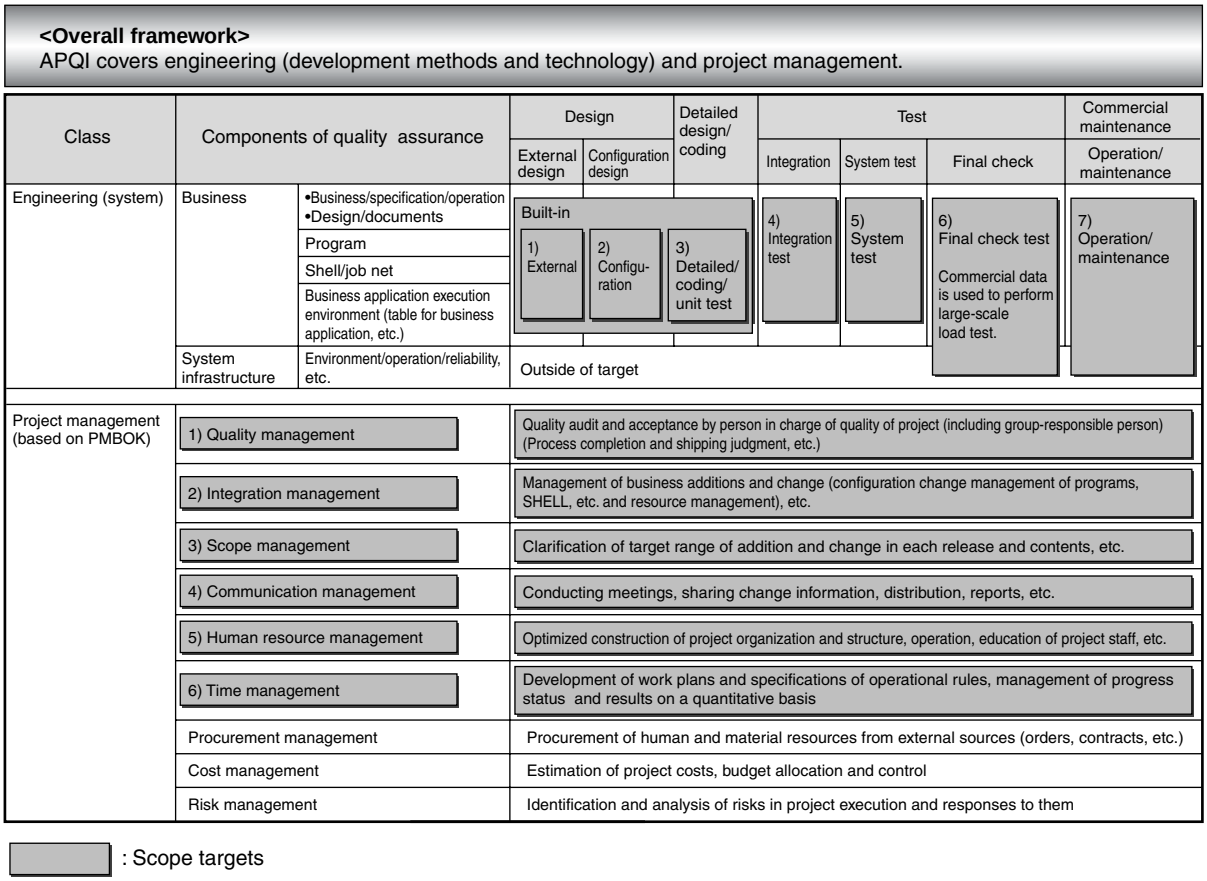

Figure 3
Application Quality Inspection (APQI) framework.

4.4 Auditing method of APQI

In APQI, the audit is conducted as prescribed in "Software Inspection,"[1] by 1) targeting deliverables, source documents (specifications, source programs, etc.), rules (specification description rule, coding rule, and procedures), and other documents; 2) verifying documents (products and work records); 3) conducting hearings based on the APQI checklist; and 4) submitting reports on the audit's results.

Countermeasures for items extracted as problems and risks are considered in cooperation with the project executive, leaders, other project members, and business/infrastructure experts belonging to the Software & Services Technology Unit, which organizes support for resolving problems. After the audit, verification of the status of items to be improved is continued. The audit is considered closed after every item to be improved is confirmed completed.

4.5 APQI procedures

Products (specifications and programs) and work processes are audited from the third-party viewpoint, and every extracted problem is thoroughly followed up and resolved. After ensuring all tasks are completed, APQI is considered closed.

The audit procedure is as follows.

1) Verification is done after clarifying its background and objective. It is performed through document verification and hearings, and its results are submitted in reports.
2) Items to be improved are improved on the project side.
3) After verification, the verifying party continuously monitors the handling status of the

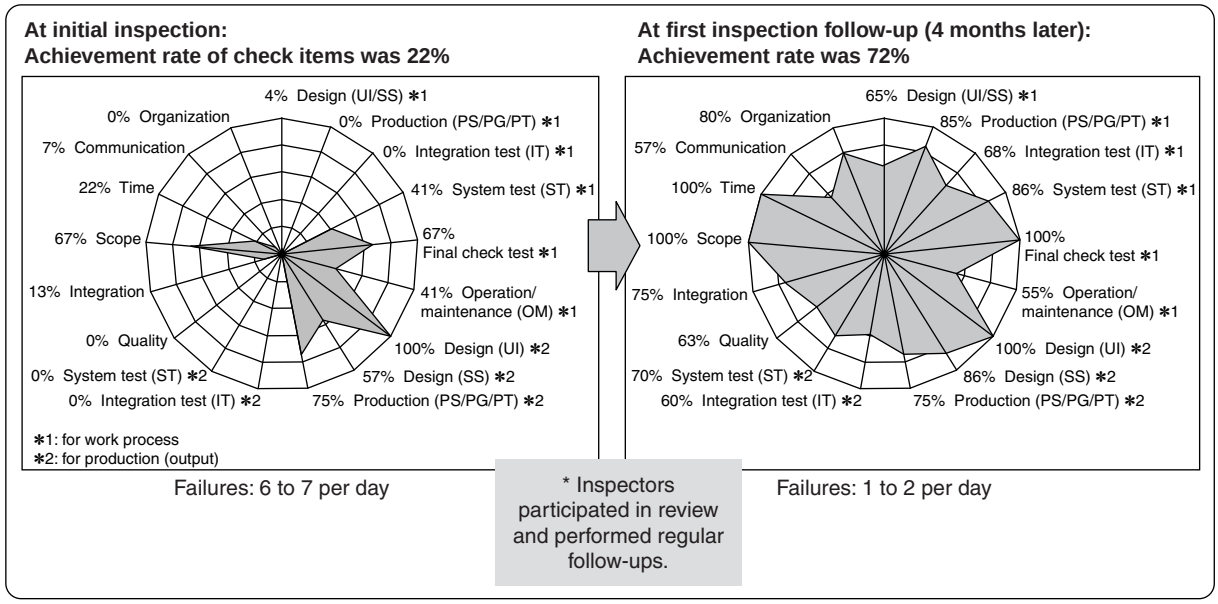

Figure 4
Application Quality Inspection (APQI) example.

items that have been improved.

4) Verification is considered closed after ensuring that every item for improvement is completed.

5. Effect of third-party quality assurance

This section describes an example of a successful improvement of a project through the third-party quality assurance.

In this project, there were continual additions of items to be improved. In the initial audit, failures occurred six or seven times a day, and in the assessment conducted by the application audit, the achievement rate of the check items was only 22%.

Therefore, countermeasures for problems extracted from the audit items on the project side were considered and continuously followed up. In an audit conducted four months later, the achievement rate of the check items soared to 72% and the failure rate was also improved to just once or twice a day (**Figure 4**). In this way, by considering countermeasures with project members and monitoring the improvement status on a regular basis, the management, development process, and products were improved and the project headed in the direction of stable, high quality.

In addition, we have audited several systems developed by other vendors based on this audit mechanism and received high commendations from the owners of those systems.

6. Conclusion

This paper described the third-party quality assurance mechanism and activities at Fujitsu. To improve these further, we must refine the mechanism by feeding back the quality improvement results.

Reference

1) T. Gilb and D. Graham: Software Inspection. Addison-Wesley Professional, 1993.

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