Process Assurance Audits: Lessons Learned

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ABSTRACT

During 1997, A large Information System (IS) Division of a Canadian Phone Company implemented formal process assurance in its Quality Assurance group. This status report presents a new perspective on the measurement of process assurance and the lessons learned after one year of assessing the individual conformance [1] of software development projects to the Corporate Software Development Process (CSDP) of the organization. This status report presents the assurance process overview, goals, benefits and scope, as well as the 1997 results overview, followed by the lessons learned, for the 1998 audit program.

Keywords

Process Assurance Measurement, Process Conformance Measurement, Software Quality, and Audit Program.

1 INTRODUCTION

This Canadian phone Company operations depend on more than 325,000 function points. This number increases yearly, as the network becomes more digital as OSS (operational support systems) and MIS (management information systems) are introduced to mechanize administration of the corporation. The major part of the software is MIS, with a majority of the systems of a hybrid nature (combination of real-time, database and graphical user interface).

Since April 1994, process assurance has been carried out informally by its Corporate Purchasing Division, figure 1, on external software suppliers. Few efforts to conduct process assurance on the internal software projects of the IS Division were attempted but had no significant impact because they were not part of the IS Division work program.

During 1997, an executive meeting held on this subject resulted in the assignment of the software process assurance mandate to be assigned to the Support Services - Quality Assurance group. A senior process assurance auditor was transferred from the Corporate Purchasing Division to formalize the Process Assurance function and document processes and products for CSDP Process Audits.

The resulting Process Assurance models and application methods have been adapted from experience gained in the Corporate Purchasing Division since 1994. and the audit processes described in the ISO 10011 [7], Trillium [2] and TickIT [9] auditing guidelines. Senior management supported this new audit process with an additional quality policy indicating mandatory use of Corporate Software Development Processes for all software development.

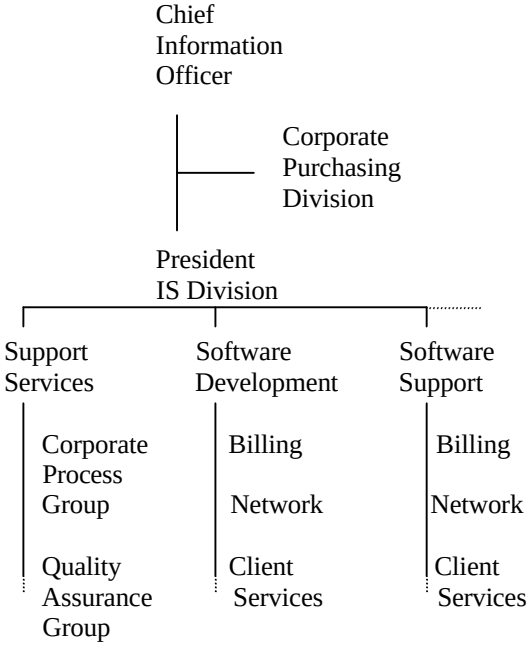

Figure 1 - Organization

The CSDP are a set of officially supported and documented processes/templates that have been adapted from an acquired software development methodology, named Project Flow, with additional components adapted from IEEE Std 1074 [5] and ISO 12207 [8] life-cycle processes. These improved processes were placed on the Intranet with easily available product templates and support tools for the project teams. . Product. is used here in a broader sense than that of ISO/IEC12207 1 [8] where a product is the set of computer programs, procedures and associated documentation and data designated for delivery to both the user and the maintainer of the software.

2 PROCESS ASSURANCE

2.1 What is the goal of the Conformance Audit?

The current goal of the Conformance Audit Process is to capture and document objective evidence of the level of a project.s conformance to the CSDP. The short-term objective is to narrow the gaps between use in practice and suggested use as recommended by the Corporate Process Group. The longer-term goal of this process is to assess and measure the Corporate Processes. effectiveness, once the IS Division use of the CSDP matures and conformance gaps begin to close. The results of both conformance and effectiveness audits will feed the Improvement Process dedicated to the Corporate Software Development Processes.

2.2 What is a Conformance Audit?

Watts Humphrey [4], who was the first to direct research culminating in the development of basic theoretical models, stresses the importance of an accurate assessment of the current situation before undertaking any efforts to improve processes. Process Assurance, or the Conformance Audit, represents a structured approach to analyzing current practices and to drawing a reliable picture of strengths and weaknesses in relation to a reference model. The assessment is not an end in itself; it is only the first step in a continuous cycle of improvement in the software development process. Organizations that adopt the goal of improving conformance to its corporate processes will often perform process Conformance Audits to ensure that the CSDP are followed and challenged.

The Audit Team evaluates information from various aspects of a project, constituting objective evidence of the actual use of the CSDP. A Project Representative is initially invited to answer a questionnaire based on relevant CSDP used during the current phase of the project. The Audit Team also relies on the collaboration of Project Management and of the Team Members of the project who will describe project processes and products during interviews and a documentation review. Finally, the Audit Team will also rely on its own familiarity with the Corporate Process tailoring guidelines and Minimum Requirements as interpreted by the Corporate Process group to prioritize their findings.

2.3 What are the benefits of the Conformance Audit for the IS Division?

No two software development projects are the same. Variations in organizational policies and procedures, acquisition methods and strategies, project size, technology and complexity, system requirements and development method influence how a system is acquired, developed, operated and/or maintained. The CSDP of an organization is written for a general project to accommodate variations as much as possible. Therefore, in the interest of cost reduction and quality improvement, the CSDP should always be tailored for an individual project. All parties involved in the project can be involved in tailoring in the early phase of a project.s definition. Note that tailoring must be addressed within the context of the Minimum Requirements criteria. The Minimum Requirements criteria ensure a basic set of obligations to which all software development projects must adhere. The Conformance Audit enables the IS Division to build a clearer understanding of the tailoring process, the Minimum Requirements guidelines, and to express that understanding in a clear and structured form. By applying a cooperative audit process with the Project Team, a Quality Assurance mentor can support the Project Team by identifying practical and realistic avenues for conforming to the CSDP. The Quality Assurance group offers this Post Audit Mentoring Service to the Project Teams after an audit has identified major nonconformance.

2.4 What Are the Deliverables of Conformance Audits?

There are two key outputs from the Process Conformance Audit. The first is a two-page executive report that summarizes the findings for the executives of the IS Division. This report is made available two days after the audit. A second, more detailed, report is issued within 10 working days of the audit. This report contains precise findings on the strengths and weaknesses of current CSDP usage in the project in relation to the intended use, and draws conformance conclusions for the Project Team. It also includes identification of missing, incomplete or inaccurate project products. Aggregate Audit Process outputs, in the form of global measurements and other feedback; provide a link to the Improvement Process dedicated to the Corporate Software Development Processes. The two-page executive audit reports are issued to the President of the IS Division.

2.5 The Audit Process overview

There are 12 steps followed during a Process Conformance Audit:

1) Choice of a project using Executive criteria;
2) Initial contact package, questions, audit plan;
3) Response from Project Manager;
4) Review response and conduct initial assessment;
5) Audit opening meeting;
6) Audit investigation interviews;
7) Audit exhibits reviews;

8) Conformance measurement (3 graphs);
9) Audit closing meeting;
10) Executive Report;
11) Detailed report;
12) Response follow-up and Mentoring.

Effort associated with an audit averaged to 11 resource/days during 1997. A two-member team composed of a lead auditor and a junior auditor did the audit. An audit group of four members could schedule one audit per week.

2.6 How do you measure conformance rating?

The measurement of project conformance is based on three essential software development project perspectives: Roles and Responsibilities, Project Management Process and Mandatory Products:

- Each of the three conformance perspectives is evaluated for the presence or absence of prescribed content. The CSDP indicate, for each of the three perspectives, minimum-tailoring guidelines, which identifies a baseline that is mandatory for all projects.
- If a main Project Role, a key Project Management Process or a Mandatory Product is absent, it will be rated as a major nonconformance.
- If a majority of the responsibilities of a main Project Role, a majority of the sub-processes of a key Project Management Process or the majority of the sub-products of a Mandatory Product are missing, it will be rated as a major nonconformance.
- When a main Project Role, a Key Project Management Process or a Mandatory Product is found, it is then subjected to a qualitative evaluation to determine if it conforms or not to the intentions of the Corporate Process.

Qualitative evaluations for Roles and Responsibilities and Project Management Processes are done using a checklist according to a progressive scale: First, is it documented; Second, is it understood; Third, is it applied with relevant objective evidence and finally, is it understood/used by other team member. For the intermediary products the qualitative evaluation is based on adapted ISO9126 criteria of Correctness, Completeness, Comprehensiveness followed by quality criteria stated explicitly fore each product in the CSDP.

Three radar charts are then produced as a result of the Conformance Audit, and aid in gap analysis. In a radar chart each category has its own value axis radiating from the center point. The center point is .0.. It represents total nonconformance. Each end-point of the value axis represents the maximum score for the dimension measured. For example, the first radar chart representing Roles and Responsibilities provides a value axis for each of the key Roles: Project Manager, Project Leader, Business Prime, Operations Prime and Account Manager. The minimum audit score for each Role is .0. and the maximum score is .1.. This score represent total conformance. The actual score lies as a data point marker on each axis between .0. and .1.. That area between the inner area and the maximum area identifies conformance gaps.

3 RESULTS FOR THE YEAR 1997

During 1997, we observed a yellow condition for process assurance on the portfolio of software development projects, which means average conformance to Corporate Processes. A yellow condition means that the average rating on all audits done that year was in the 35% to 69.9% conformance range. A red condition is 35% and a green condition is 70%.

3.1 Roles and Responsibilities: Results for 1997

The resulting conformance graph, figure 2, depicts how well the Project Roles and Responsibilities were assigned, understood and used by the Project Teams. Reasons associated with each deviation were analyzed and the top two nonconformance causes were:

1- Informal assignment of role 47%
2- Responsibility poorly executed 21%

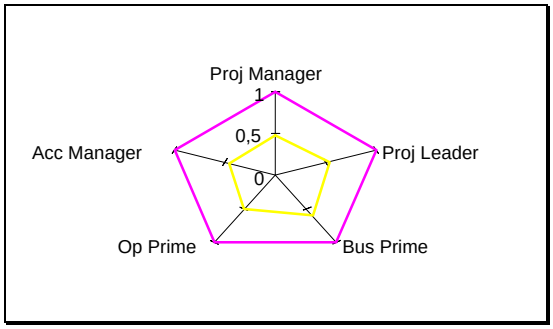

Figure 2: Roles and Responsibilities: 1997 rating

3.2 Project Management Process: Results for 1997

The resulting conformance graph, figure 3, depicts how well the Project Management Process was understood and used. Reasons associated with each deviation were analyzed and the top two nonconformance causes were:

1- Informal Planning Processes 41%
2- Informal controls 18%

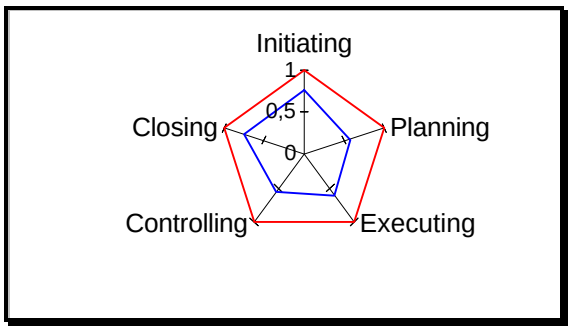

Figure 3: Project Management Process: 1997 rating

3.3 Mandatory Products: Results for 1997

The resulting conformance graph, figure 4, depicts the absence/presence of the Mandatory Products, and, when present, the resulting qualitative rating of the products. Reasons associated with each deviation were analyzed and the top three nonconfomances were:

1- Lack of awareness of tailoring guidelines 34%
2- Incomplete/inaccurate product content 21%
3- Misuse or absence of product template use 12%

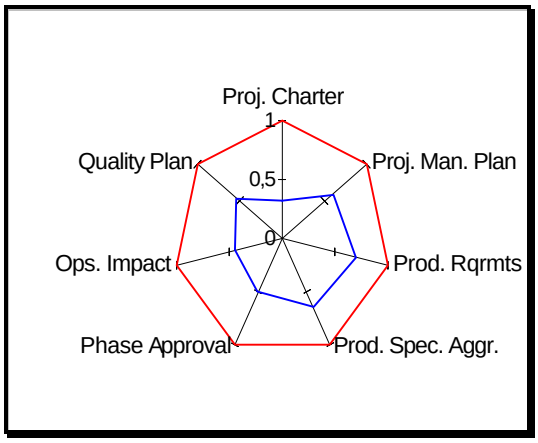

Figure 4: Mandatory Products: 1997 rating

4. OBSERVATIONS AND LESSONS LEARNED

The results indicate that nonconformance will continue to be a problem unless the Corporate Process Group and the Quality Assurance group address the following changes in the 1998-work program:

- Focus on a small set of practices. Initially, the Audit Team asked the Corporate Processes Group for a limited number of practices as the focus of the Conformance Audit. Consensus was not reached, leaving the auditors to identify any conformance issue for key recommendations. This strategy does not help the organization focus on a limited number of practices and disperses individual project improvements. There should be a base set of practices to establish a focus for process improvement. We recommend an initial focus on a restricted number of CSDP identified as SEI/CMM Level 2 practices that are systematically non-conformant.
- Freeze Corporate Processes. A significant number of nonconformance are associated with the understanding by the Project Team of what the tailoring guidelines and minimum requirements mean to their daily work. Since the Corporate Processes changes too frequently, there is a need to:
  1) Stabilize releases of processes in fewer versions
  2) Train the Project teams fully on each new version of the CSDP.
- Scope to include customer organization. A considerable number of the nonconformances associated with roles are associated with a false understanding of what the customers and other IS/IT organizations are supposed to contribute to the projects. Since the scope of the audit excludes these groups, this will continue to be a problem unless the audit scope is expanded.
- Categorization of findings. Although Project Teams have seldom disputed the findings, there is growing difficulty in reporting audit trends without proper categorization of nonconformance causes.
- Audit follow-up. The current audit process does not systematically follow up on the corrective actions. We strongly agree with Craig [3] who states that .audit standards must describe the basic elements of a good closed-loop corrective action system..
- CMM level 2. Although there is an informal statement that the organization aims of CMM level 2, there is a pressing need to undertake formal improvement program activities that are tightly linked with the audit program.

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