An Overview of the Change Management Process and Examples of Software to Help Organizations Effectively Manage Change

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Abstract—**Every organization undergoes change on a continual basis and must understand how to manage the change process. This article overviews change management and discusses software packages and other tools that can help organizations manage the inevitable changes which occur frequently. It also examines risks and control objectives associated with change. It concludes that organizations often overlook proper change management techniques and can benefit by the ideas discussed in this article.**

Keywords-change management; software; IT

I. INTRODUCTION

"The only thing constant in life is change." This quote is attributed to the philosopher Heraclites of Ephesus and seems to be equally attributable to both organizations and to personal lives. The ability to manage change in both areas is very important.

This paper provides an overview of change management in organizations, beginning with its definition and purpose. The importance aspects of a change management process are presented based on best practices in the field as described by two major organizations. There is also a section on risks and control objectives that presents information about risks and challenges associated with changes and change management processes related to databases, software development projects, and software product lines.

The next section discussed two software packages that help companies manage their change management. The last section focused on the activities that can be used by an IT auditor to audit a company's change management procedures.

In the process of completing this article, one important finding was the apparent absence from authoritative peer-reviewed literature of detailed aspects of a typical change management process, and information on how the process works for all major systems; in particular operating systems and employee-provided personal computers. It seems as if the public discussion on change management, even by developers of change management software and IT companies, focuses more on the overall aspects, goals, and purposes instead of providing steps, scenarios, and consequences. The information

is probably available somewhere but the sources are not readily available in the public domain for review.

II. DEFINITION AND PURPOSE

According to the Institute of Internal Auditors (IIA), a change management process is composed of steps and must include a formal set of procedures. The steps and procedures are necessary to manage changes, updates, or modifications throughout an organization and including its hardware and software systems [1].

In a white paper about change management at Cisco Systems [2], the dependency of organizations in all industries on IT and a "highly available network" to meet their business objectives was highlighted. The document also described change management as "one of the most important service management processes" due to the large volume of changes any organization will undergo for a variety of reasons. These reasons could include accommodating new business requirements and correcting errors in different areas. Therefore, the general purpose of change management is to control the release of changes; this is critical because all of the changes have the potential to be disruptive [2].

Cisco also stated that the purpose of change management is to ensure that standardized methods and procedures are used, all changes are handled efficiently and promptly, all changes are recorded, risk to business processes is minimized and all changes are authorized and aligned with the company's business needs and goals. Besides reducing the risk exposure, the changes must also be successful on the first attempt [2].

The purpose of change management is also to focus on the changes that individual, teams, and leaders have to manage in order to coordinate and meet their clients' requirements. Individuals inside an organization must meet certain characteristics in order to approach their work processes, teams must be able to reorganize and adapt to the changes, and leaders must be able to "change their roles, styles and skills for different phases of the change." The human changes will add to the inevitable changes to the IT systems used to manage client data, including complex organizational data governance frameworks [3].

III. IMPORTANT ASPECTS OF A CHANGE MANAGEMENT PROCESS

In a typical change management process, changes must be formalized through a management-approved policy. The major components of the policy should include the scope, authorization and approval, testing requirements, and segregation of duties. The scope should describe the types of changes and systems that fall under the policy. The policy should also describe any changes that are exempt and which must have been documented and approved [1].

When it comes to testing requirements, the users and system owners must test and approve the changes before they are implemented and impact the production environment. The proper personnel should conduct the physical act of implementing the change; he/she must be considered an independent person, such as a change and release manager [1].

All changes should be documented and tracked using a change management system. When the change initiator has completed a change request, it is documented, and several codes can be used to reflect the status of the request from that moment on. The most common codes are open, in-progress, approved, rejected, closed, and canceled [2].

Typically, there are at least four major roles involved in a change management process. There are different responsibilities for individuals involved in each role and it follows a specific order. First, there is the initiator, who perceives a need and then completes the necessary steps to meet the initial requirements to prepare a Request for Change or RFC. Second, there is a change manager or someone in the organization who is assuming this role for a specific project. This individual will update and communicate change procedures, lead a team to review and accept change requests, audit network changes, and create and compile metrics, among other things [2].

Third, there is a change advisory board that supports the authorization of changes and assists with assessment and prioritization of changes. It must include individuals with understanding of various stakeholder needs, and must include representation from all stakeholder groups involved or impacted by the change. Fourth, there is an implementation team who receives the authorized RFCs, "builds the changes, pre-test the change, completes the change deployment plan, implements the change, and tests the infrastructure post-change" [2].

IV. RISKS AND CONTROL OBJECTIVES DATABASES

There are many different types of changes that a database administrator (DBA) will need to make to a database over its lifetime. Many of the changes can be made using the SQL ALTER statement, but other types of changes require additional steps. One of the risks to consider is that of the DBA not realizing that a simple database change becomes more complex when it has to be propagated to multiple databases on various servers and at many different locations. A single complex change such as removing or renaming a column can take several additional hours and require hundreds of changes that would have to be scheduled, executed, and verified [4].

Another challenge is to keep test databases synchronized and available for application program testing. There are risks involved in developing in-depth procedures for the creation of new test environments (which requires the duplication of a master testing structure), and in creating scripts to set up the database according to the needs before each test run. These risks must be taken into consideration because once the scripts are created the application developers will have to run them as needed [4].

There is always a risk that a database change could be improperly specified. Recovery from such a change and/or backing off a migration to a prior point in time can also be a major challenge. One way to mitigate these risks is to purchase a database change management tool in order to streamline the process and remove from the DBA's shoulders the burden of ensuring that other major problems do not result as a consequence of the change. Although the change management tools can help reduce time, effort, and human error, planning is the best way to ensure the change management process is successful [4].

V. SOFTWARE DEVELOPMENT PROJECTS

Volatility in customer requirements is one of the major risks and causes of failure for software development projects. One of the issues is change-management practices that don't adequately support the process of continuous evolution. Software configuration management (SCM) practices help in controlling changes and generating reports but do not adequately support change management [5].

SCM does not manage changes to other artifacts like requirements and design documents, and it doesn't manage dependencies among many artifacts, although it is an essential process for maintaining the system's integrity. Traceability tools are used for this purpose, and although they share a common goal with SCM, both work independently of each other. After a study was conducted on the benefits of integrating traceability and SCM practice, the authors identified several benefits and emphasized the importance of such an approach, in spite of significant challenges [5].

VI. SOFTWARE PRODUCT LINES

Product line development organizations often ask the following questions. Are there general patterns of change that are common in product lines? What change management practices can be used to effectively manage the changes? Software product lines (SPL), experience several challenges due to the evolution of several variants in the product platform. Sophisticated change management systems are used but even then, adequate management of complex interdependent changes in different product variants is not achieved. If left unchecked, this problem could potentially undermine the advantages of using a platform and result in a fragmented product line [6].

One study has identified three patterns and has suggested practices to address the challenges they present. The first pattern, for example, was described as "interdependencies among changes in variants" and means that as product variants evolve, the changes in product variants become dependent on one another and pose a problem in managing product line evolution. The authors recommended modularization, so that variation points are designed to be independent and changes made to product variants are isolated from other changes [6].

VII. CHANGE MANAGEMENT SOFTWARE SPARTAN SYSTEMS

This company offers the "TrackWise Change Management" software solution which "enables all documented changes to be properly coordinated while increasing transparency by managing the change control process across all relevant departments from initial request, through pre- approvals, change execution, follow- up approvals and implementation." The software helps document every detail of a change request, and by doing so, helps the company maintain control of changes made throughout the enterprise and reduce business exposure due to quality control issues. The software keeps a running workflow so that management can evaluate the risks associated with a change and corrective action can be deployed right away to minimize risk exposure [7].

VIII. DASSAULT SYSTEMS AND BIOVIA

These companies purchased Qumas, a company that offers a "Change Control Process Package." The package contains "advanced, out-of-the-box, business process management functionality" with process compliance configuration designed specifically for change control management. It includes a workflow of tasks from initiation to approvals, appropriate user selections from pre-defined roles for each task, and dynamic forms. It also includes a design document, a validation pack, an end-user training course and a system access plan. The company provides professional services that include installation, train-the-trainer training, and a professional services review after the system has been operating for three months [8].

IX. IT AUDITOR AND CHANGE MANAGEMENT

The auditor is the one responsible for providing assurance that a change management policy and framework are in place. He/she must attest that a formal change management process was followed consistently when accounting for all changes to the production systems. The auditor is also responsible for ensuring that the organization educates users of the process on all the steps and responsibilities involved [1].

During the initiation stage, the auditor must determine whether enough detail has been provided in the inquiry form to make a decision. The auditor should also verify that support for the change inquiry has come from a business manager or someone with the authority to do so. During the

categorization stage (when an authorized person reviews the change inquiry and categorizes it as a change request by giving it a number for tracking purposes), the auditor must verify that all inquiries have received a unique number, that all change requests have been considered by management, and that a risk assessment has been conducted to categorize further the change requests that were accepted [1].

During the release stage (once the change request has been designed and tested), management should approve its release into the production environment. The auditor must ensure that only change requests have moved to this stage, and that all the documentation needed to support management's decision has been included. During the migration stage, the auditor must ensure that an independent person conducts the migration of code into the production environment, in order to minimize the risk of unauthorized changes being made to the production code. The auditor must check the security access profiles of users and developers to ensure that everyone's access is restricted to their corresponding authorized functions [1].

Last but not least, the auditor should ensure that temporary access granted to personnel during emergency changes is removed once the work is completed. The auditor should also document that open changes are managed and closed out promptly and that timely reports are written, distributed, and reviewed by management. These auditor's interventions (and others procedures presented above) can help the organization identify and manage the risks associated with system changes in a timely fashion.

X. CONCLUSIONS

This article has examined the process of change management and has discussed a number of software packages and other tools to help implement change management in organizations. Organizations often manage change poorly, and the information in this article should prove useful to help manage the inevitable changes which occur in all organizations.

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