

# Improving Change Management Systems and Processes

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**Abstract**—IT service change management aims to ensure that new services and changes to services will be deliverable and manageable at the agreed cost and service quality. Change management is an attractive research topic due to its complicated nature (broad scope, a large number of interfaces, many instances). Our research exploits the best practices of IT Infrastructure Library (ITIL) framework. The research problem of this study is: Which factors should be taken into consideration while implementing IT service change management systems and processes? The main contribution of this paper is to present results of a case study with a Finnish IT service provider organization that provides ICT and medical technology services in Finland. Our results consist of identified functional and data requirements for a change management module within an IT service management system as well as practical implications for change management process implementation. The case study was carried out as a part of a research project that focused on improving Service Transition processes.

**Keywords**—IT service; change management; change; process

## I. INTRODUCTION

IT service change management aims to ensure that new services and changes to services will be deliverable and manageable at the agreed cost and service quality. According to the IT Infrastructure Library Glossary [1], an IT service change can be understood as “*addition, modification or removal of anything that could have an effect on IT Services and the scope should include all IT services, configuration items, processes, documentation etc.*”

There are four key challenges related to IT service change management. First, change management occurs in many organizational levels. Top management has to deal with totally different types of changes (typically strategic changes incl. changes to a service portfolio and supplier changes) compared to the changes carried out by operative management (changes to service components, technologies and tools). Second, even in operative change management, there are several types of changes that need to be processed through different change models. Third, IT service organizations often seem to lack the comprehensive understanding what is a change, how does it differ from daily operative activities, service requests and error correction work. Fourth, the interface between release management and change management often remains unclear. Release management activities are performed in order to implement the change. After the the release management process has delivered a release that can contain one or several changes, change management is responsible for organizing the Post

Implementation Review meeting. The challenges may exist in relating changes to releases.

In our study, the goal is to improve change management based on the process improvement frameworks that support IT service change management. The most widely used best practice framework for IT service management is IT Infrastructure Library (ITIL) that describes the service lifecycle with five stages: Service Strategy [2], Service Design [3], Service Transition [4], Service Operation [5] and Continual Service Improvement [6]. In addition to ITIL, there is a well known IT governance framework COBIT that defines control objectives for the change management process [7]:

- Develop and implement a process to consistently record, assess and prioritise change requests.
- Assess impact and prioritise changes based on business needs.
- Assure that any emergency and critical change follows the approved process.
- Authorise changes.
- Manage and disseminate relevant information regarding changes.

There are several international standards that IT service provider organizations may use to benchmark their processes. ISO/IEC 20000-1:2010 Part 1: Service management system requirements [8] and ISO/IEC 20000-2:2011 Part 2: Guidance on the application of service management systems [9] are descriptive standards that define requirements for IT Service Change Management. In the ISO/IEC 20000, change management is visible in several areas, such as in:

- Planning and implementing new or changed services (*All service changes should be reflected in Change Management records.*)
- Service reviews (*The service provider and customer(s) should hold service reviews, at least annually and before and after major changes.*)
- Change management (*The change management processes and procedures should ensure that changes have a clearly defined and documented scope; only changes that provide business benefit are approved, changes are scheduled based on priority and risk; changes to configurations can be verified during*

*change implementation; and the time to implement changes is monitored and improved where required.)*

The recently published ISO/IEC TS 15504-8:2012 process assessment model [10] provides a systematic framework to measure change management capability.

Much has been written about change management from traditional software engineering and IT management perspective. The study of Sauvé et al. [11] provides a formal method to automatically assign priorities to changes by exploiting a Business-Driven IT Management (BDIM) approach and state that risks associated with changes can be calculated and changes prioritized in an automatic fashion. The most interesting part of their study is the description of the service level agreement (SLA) clauses related to changes (in their case, any security-related RFC costs 1000 USD/hour until the change is implemented). We are also interested in our research to explore more deeply the change-related SLAs.

Hagen and Kemper [12] have proposed an algorithm for the automated detection of conflicting IT change plans. The detection was done based on an object-oriented Configuration Management Database. Machado et al. [13] have investigated how change activities can be grouped together forming atomic groups of activities by using Business Process Execution Language (BPEL). Release management is an important sub-process of change management. Release management has been examined by several studies. Jäntti and Sihvonen [14] have examined the patch and release management activities in Finnish IT service provider organizations. Van Der Hoek and Wolf [15] have explored requirements for release management. Jansen and Bringkemper [16] have presented common misconceptions about product software release management. Furthermore, Jokela and Jäntti [17] have identified challenges in release management process by using product portfolio management perspective in energy domain.

The research gap can be identified in change management from IT service management perspective. Significantly more academic studies are needed to investigate how IT service provider organizations carry out change management activities, measure the performance of change management, and assign roles and define responsibilities to perform the process.

This study was conducted during Keys to IT Service Management and Effective Transition of Services ( KISMET) research project where one of the industrial partners was interested in change management process improvement. The **research problem** of this paper is: Which factors should be taken into consideration while implementing IT service change management systems and processes? The main contribution of this study is to

- show functional and data requirements for change management systems,
- present observations from a change management process improvement pilot, and
- provide lessons learnt from change management process improvement.

The results of this study can be used to improve change management systems and processes of IT service provider

organizations. The remainder of the paper is organized as follows. In Section 2, the research methods of this study are described. In Section 3, we present the results of the study. Section 4 aims at analysing the findings of the study. The conclusions are given in Section 5.

## II. RESEARCH PROBLEM & METHODOLOGY

The research problem of this study is: Which factors should be taken into consideration while implementing IT service change management systems and processes? The research problem was divided into the following research questions:

- Which data fields should be included in the Request For Change (RFC)/change record?
- What are the benefits of change management process?
- How change management activities are carried out in the case organization?
- Which roles are related to change management?
- Which interfaces does the change management have with other ITSM processes?

### A. The Case Organization and Data Collection Methods

Our case organization ITSM Ltd (we use a fictive name to maintain the anonymity of the case) is an IT service provider company that provides ICT and medical technology services for municipalities and public health care sector. Our case organization has around 220 employees. The case organization uses ISO/IEC 20000 IT service management standard as a management framework for IT services and service management processes. This case study focused on IT service change management. The topic of study was selected by the case organization's representative.

The following data collection methods/sources were used during the study:

- Documentation (change management process description)
- Archives (change request records, service request records)
- Interviews/discussions (change managers, development manager, product/service managers)
- Participative observation (observation period in the case organization, 2 weeks; a change management workshop for product managers, 2 hours)
- Physical artefacts (access to the organization's intranet, demonstrations of a change management tool)

The research team established a case study datastore to manage the material received from the case organization and the material created by researchers. The research team focused on analyzing the documentation and comparing it to IT service management best practices rather than finding errors. The deviations that the team found were reported to the case organization's representatives. According to Yin's [18] case study principles, we established a chain of evidence between data sources and findings. We also created a case study

datastore for the team's internal use. The datastore proved out to be a valuable tool when we created the case study report to the case organization.

A combination of action research and case study research methods was used as a main research method. It is especially important that action research involves a team that includes both researchers and subjects as co-participants in the enquiry and change experiences on the chosen topic [19].

Baskerville [19] defines action research as a two-stage process. In the diagnostic stage (Stage 1), the researcher and the subjects of the research perform a collaborative analysis of the social situation. In our study, collaborative analysis refers to joint meetings with the case organization's change management specialists, change managers, and a development manager. In these joint meetings, the current state and the target state of change management was discussed. In the therapeutic stage (Stage 2), collaborative change experiments are performed. This stage focuses on introducing changes and studying the effects of changes.

Action research suits well to situations where the goal is to improve working practices and find solutions to existing business problems. The research team did not work only as an external observer but also created material for the change management process. Action research methods were supplemented by case study methods. According to Yin [18], a case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context". We used an exploratory case study with a single case design.

### B. Data Analysis

The case study data was collected and analyzed by three researchers using a within case analysis technique [20] that focuses on analyzing each case stand-alone before making any comparisons. Research findings were validated with the case organization's change manager and development manager and discussed in the workshop with product managers that played change manager roles. The case study report was produced after the case study findings and was delivered to the case organization's contact persons. This paper documents only part of the findings and research questions that were captured in the case study report.

## III. IT SERVICE CHANGE MANAGEMENT - STUDY FINDINGS

We used KISMET (Keys to IT Service Management Excellence Technique) model as a process improvement tool. The model consists of the following seven phases: Create a process improvement infrastructure, Perform a process assessment, Plan process improvement actions, Improve / implement the process based on ITSM practices, Deploy and introduce the process, Evaluate process improvement and Continuous process improvement. The KISMET model provided researchers a roadmap for the process improvement work.

In this section, we provide a summary of the case study results. We shall start with the functional and data requirements for a change management system.

### A. Functional requirements for a change management system

During the study, the functional requirements were identified to improve the existing change management system. The case organization had an old ticketing system that had been created (exceptionally) within the organization. We collected requirements from discussions with a change manager and development manager and edited the comments to match ITSM terminology. The following list captures the functional requirements that we identified:

- The system should enable easy reporting of changes by any employee.
- The system should enable separating development ideas from service requests and incidents.
- The system should enable categorization of changes (major, minor, emergency).
- The system should provide appropriate reports to the change management actors (e.g., number of implemented and failed changes by type and time period; throughput times for changes by change type).
- The system should enable linking incidents, problems and service requests to change records.
- The system should be able to maintain the change history (change log).
- The system should have a relationship to the Configuration Management System to enable collecting information on faulty/vulnerable/resource consuming configuration items.
- The system should be able to support Change Advisory Board (CAB) meetings and provide CAB members actions for reviewing, accepting or rejecting change requests.

### B. Data requirements for a change management system

The following data requirements were identified for the change management system. Data requirements were captured by analyzing the specifications of existing ITSM system and comparing it to other ITSM tools and ITSM best practices.

- Unique identifier
- Date of creation
- Change requestor's information
- The target of the change
- Trigger of the change
- Title of the change request
- Description of the change (what do you want to change, what kind of user groups are affected by the change)
- Service Area
- Reason for change
- Estimated impact of the change
- Change category (standard, normal, emergency, major)

- Schedule, required resources and costs
- Change priority (low, normal, urgent)
- Change effects (affecting a single user, department, or entire organization)
- Recovery Plan
- Impact assessment (resources, capacity, costs and benefits)
- CAB decisions and recommendations
- Accepted/rejected date
- Change status
- The authorization date
- Estimated completion date
- Due date of change (Business opportunity window)
- The actual date of change introduction
- PIR meeting
- PIR evaluation data
- Closure code (success, canceled, abandoned, postponed, implementation)

#### C. Roles related to the change management process

We observed that change management roles were well visible in the change management process description. The change manager was also responsible for maintaining the process description document. The following roles were identified based on the change management process description:

- Change manager (monitors change requests and implementation of changes, ensures that the process fills its outcomes and purpose, ensures that the process fills the requirements of ISO/IEC 20000, performs continual service improvement)
- Change proposer (a customer, service desk or a specialist identifies a need for a change)
- Change processor (monitors change requests and queues, records change request details in the ticket, if the change proposer has not done it, carries out a preliminary assessment and classifies the change request, calls the CAB, is responsible for implementing the change and Post Implementation Review(PIR))
- Problem manager (responsible for emergency changes during office hours, calls the CAB meeting)
- Application Team duty officer (responsible for emergency changes outside office hours, calls the CAB meeting)
- CAB, Change Advisory Board (evaluates the effects of the change, makes decisions on changes)
- Change Implementor (implements the change by utilizing release management and configuration management, records change history)

#### D. Improving the change management process

During the study, the research team provided the case organization with a list of suggestions how improve the change management process. Before we present improvements, we have to note several positive findings on the organization's IT service management. First, processes were in good shape. Each process had been clearly and consistently documented and given a responsible person (process manager). Service management employees seemed to be well committed to continuous learning and improvement. We witnessed open information sharing on current challenges (ITSM tools and processes) and that they had been trained how to identify process problems and learn from failures. Some of employees reported that getting a training certificate or an ITSM standard should not slow down the learning and that there is always something to improve. Employees also indicated that management is well committed on improving service quality.

Improvement suggestions/challenges were related to the following parts of change management (the source of an issue is presented in parentheses: Documentation (Do), Archives (Ar), Interviews/Discussions (InD), Participative observation (Po), Physical artefacts (Pa)).

- Post Implementation Reviews for changes (Pa, InD, Ar)
- Increasing awareness of change management practices by organizing Process Manager forums (InD)
- Evaluation and estimation of the changes (Po: Change management workshop)
- Information sharing on change management through a centralized datastore (InD).
- Defining interfaces between change management and other ITSM processes as well as IT project management (Do, Po, InD)
- Defining the change management metrics (Do, Pa, InD)

In almost all of our process improvement case studies, we have observed a need for clearly defined interfaces between IT service management processes. This case revealed the need to define the interface also between change management and project management. This interface is very interesting from the following reasons: First, implementing a change as a project allows the service provider organization to better charge the customer for the work required to achieve objectives of the change. Second, because the size and the complexity of the changes varies, there is a need for guidelines and models that help the organization decide how the change shall be completed. The change can be completed in several ways: as a project, as a normal change or as a hybrid model that is coordinated by a business relationship manager until there are project resources available.

Figure 1 shows the interface between project management and IT service management in the context of non-standard change.

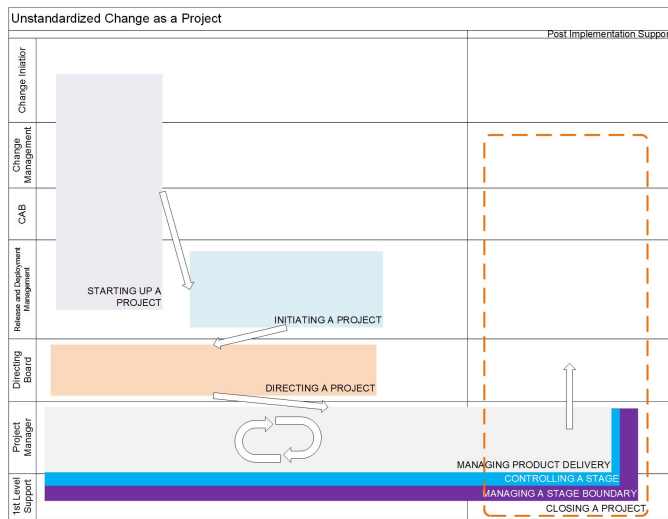


Fig. 1. Interface between project management and IT service management

PIR Meeting – Failed Change Form			
Why did the change implementation fail?			
Was a change back-out plan used?	Yes / No	Successful reversal?	Yes / No
If a change back-out plan was not used, describe why?			
Potential corrective actions:			
Task nro.	Description	Duration	Responsible person/group
Lessons learnt (How a failure could have been prevented?)			

Fig. 2. The draft version of the PIR form

#### IV. ANALYSIS

The data analysis was carried out by using within case analysis technique that focuses on creating a rich view on the case organization’s behavior before making any conclusions. Each data source was analyzed from the viewpoint of research questions. In this section, we provide the analysis of findings in the form of lessons learnt. The following lessons learnt were derived from the study.

**Lesson 1: Conduct Post Implementation Reviews for changes.** Post Implementation Review group should meet after the change implementation and evaluate the success of change (causes, goals, improvement suggestions) and perform a detailed investigation for failed/unsuccessful changes. During the study, we created several templates to assist change management tasks. Figure 2 shows the Post Implementation Review form that should be filled in the PIR meeting in case of a failed change.

**Lesson 2: Increase communication on change management practices by organizing Process Manager forums.** Interviews showed that process managers need discussion forums to discuss on process practices and make them more unified.

One of the interviewees reported: *The challenge is to get daily work and processes together.* In addition to CAB meetings, one could organize change management meetings where change managers and specialists that are related to managing changes could share experiences on change management practices and tools.

**Lesson 3: Change evaluation.** The change management workshop highlighted the importance and complexity of change evaluation. A participant of the change management workshop stated: *The most challenging part in change management is to estimate the scope and the effects of changes. The evaluation of change is equal to risk estimation.* The change management system should support the decision making, for example, showing the dependencies between service components and modules. Here, the configuration management database plays an essential role.

**Lesson 4: Identification of changes.** An interview with one of the process managers revealed that employees need guidelines how to identify changes/requests for change and how to separate them from other requests, such as service requests. Interviewees also addressed the need for practical level ITSM training.

**Lesson 5: Centralized place for change management guidelines.** According to our observations, information on the change management was stored in separate locations, which made it difficult to get an overview how process is executed and monitored. A solution could be to establish an intranet site for change management guidelines and reports. Additionally, we suggested that communication channels to change management office should be clearly visible for employees, such as in the form of an email address (cmo@company.com). The change management office should also communicate its service offering for the organization’s employees, for example, which change management training is available.

#### Lesson 6: Define change management interfaces

During the study, we found that the case organization’s change management process had relationships with configuration management, service request management, business relationship management, service level management, release and deployment management, IT financial management, security management, and availability and continuity management. The interface with project management had been mentioned in the change management process description but required clarification. Thus, we provided a visual description of the interface.

#### Lesson 7: Measuring the performance of change management

A typical challenge in IT service management is how to measure the performance of ITSM processes. A good starting point is to identify critical success factors, key performance indicators and metrics. For example,

- Critical success factor: Service quality and protection of the service.
- Key performance indicator: Percentual decrease in failed changes.
- Metrics: Number of failed changes.

We observed that most of the change management metrics were documented in form of KPIs: Decrease in number of defects due to unauthorized changes, decrease in number of failed changes, decrease in SLA breaches due to changes, decrease in number of urgent changes, better pre-estimation of changes. Our suggestion was to define metrics that the process and tools support. For example, if one would like to use 'decrease in number of failed changes' as a KPI, one has to know exactly the number of failed changes. Additionally, there must be clear rules and criteria what is a failed change. This leads to defining limits and allowed tolerances, for example, a change becomes a failed change when a change implementation exceeds the estimated budget with more than 10 per cent. Our findings support some of the earlier studies in change management such as the study of Sauvé et al. [11] that indicated the need of careful planning of change-related SLAs. In our study, we also identified that it is challenging to create SLAs for error corrections that usually go through problem management process. While change management is often discussed in the context of organizational changes and software change management, this paper focused on innovative aspect of change management: IT service change management which is important topic for any IT service company. While designing a change management system, it is not enough to focus just on internal requirements (functions and data). One should also take into account the external metrics, such as usability, availability and user satisfaction.

## V. CONCLUSION

The research problem of this study is: Which factors should be taken into consideration while implementing IT service change management systems and processes? By using case study and action research methods, we performed a study in an IT service provider organization and focused on exploring IT service change management from a tool and process perspective. As key results, we presented functional and data requirements for a change management system, benefits that the organization has received from improving change management, and roles and responsibilities within change management.

The key improvement ideas we identified were related to organizing frequent Post Implementation Reviews both for successful and failed changes, classification of changes, defining change management interfaces both with service management processes and project management.

This following limitations are related to our study. First, data were collected from manager level representatives during a relatively short time period (2 weeks). Although we managed to get a rich set of material (5 interviews, informal discussions, 15 documents, 7 observation periods) time should be spent on the data collection and analysis to increase the amount of observation and interviews. Data collection and analysis of employee level information could have provided richer viewpoints to the research topic. Second, we used a single case design in this study. We agree that this causes generalization difficulties for our results. However, case studies and action research studies do not have to lead statistical conclusions. Instead, they can be used to improve the theory. Here, we focused on contributing to IT service management and change management theory. Further research could explore in more

detail the interfaces between IT service management processes and IT project management.

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## REFERENCES

- [1] IT Service Management Forum, "Glossary of terms and definitions," Technical Report, 2007.
- [2] Office of Government Commerce(a), *ITIL Service Strategy*. The Stationary Office, UK, 2007.
- [3] Office of Government Commerce(b), *ITIL Service Design*. The Stationary Office, UK, 2007.
- [4] Office of Government Commerce(c), *ITIL Service Transition*. The Stationary Office, UK, 2007.
- [5] Office of Government Commerce(d), *ITIL Service Operation*. The Stationary Office, UK, 2007.
- [6] Office of Government Commerce(e), *ITIL Continual Service Improvement*. The Stationary Office, UK, 2007.
- [7] COBIT 5, *Control Objectives for Information and related Technology: COBIT 5: Enabling Processes*. ISACA, 2012.
- [8] ISO/IEC 20000:1, *Part 1: Service management system requirements*. ISO/IEC JTC 1 Secretariat, 2010.
- [9] ISO/IEC 20000:2, *Part 2: Guidance on the application of service management systems*. ISO/IEC JTC 1 Secretariat, 2011.
- [10] ISO/IEC TS 15504-8:2012, *Information technology - Process assessment -Part 8: An exemplar process assessment model for IT service management*. ISO/IEC TC JTC1/SC7 Secretariat, 2012.
- [11] J. Sauve, R. Santos, R. Reboucas, A. Moura, and C. Bartolini, "Change priority determination in it service management based on risk exposure," *Network and Service Management, IEEE Transactions on*, vol. 5, no. 3, pp. 178–187, 2008.
- [12] S. Hagen and A. Kemper, "Towards solid it change management: Automated detection of conflicting it change plans," in *Integrated Network Management (IM), 2011 IFIP/IEEE International Symposium on*, 2011, pp. 265–272.
- [13] G. Machado, F. Daitx, W. da Costa Cordeiro, C. Both, L. Gaspary, L. Granville, C. Bartolini, A. Sahai, D. Trastour, and K. Saikoski, "Enabling rollback support in it change management systems," in *Network Operations and Management Symposium, 2008. NOMS 2008. IEEE*, 2008, pp. 347–354.
- [14] H.-M. Sihvonen and M. Jantti, "Improving release and patch management processes: An empirical case study on process challenges," *Proceedings of the International Conference on Software Engineering Advances (ICSEA 2009)*, vol. 0, pp. 232–237, 2010.
- [15] A. van der Hoek and A. L. Wolf, "Software release management for component-based software," *Softw. Pract. Exper.*, vol. 33, no. 1, pp. 77–98, 2003.
- [16] S. Jansen and S. Brinkkemper, "Ten misconceptions about product software release management explained using update cost/value functions," in *Proceedings of the International Workshop on Software Product Management*. Washington, DC, USA: IEEE Computer Society, 2006, pp. 44–50.
- [17] K. Jokela and M. Jantti, "Challenges and problems in product portfolio release and deployment management," in *Proceedings of the 9th International Conference on Service Systems and Service Management (ICSSSM12)*. Shanghai, China: IEEE, 2012.
- [18] R. Yin, *Case Study Research: Design and Methods*. Beverly Hills, CA: Sage Publishing, 1994.
- [19] R. Baskerville, "Investigating information systems with action research," *Commun. AIS*, p. 4.
- [20] K. Eisenhardt, "Building theories from case study research," *Academy of Management Review*, vol. 14, pp. 532–550, 1989.