Towards an Improved IT Service Desk System and Processes: A Case Study

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Abstract—An IT service desk provides a Single Point of Contact for the customers and users regarding support requests. The world-wide adoption of IT Infrastructure Library (ITIL) framework has also pushed organizations to improve their service desk operations. However, improving the service desk is a serious challenge for many IT service providers. Many government organizations in Finland have started to use ITIL in their service desks and need help in configuring service desk tools and defining processes. The research problem of this study is: How could an IT service provider's service desk operations be improved by using IT service management best practices? The main contribution of this paper is to present results of a case study on IT service support in Finnish Tax Administration. First, the customer support challenges are described. Second, we present how these challenges were solved by using ITIL-based practices. Third, we show how service desk performance and ITSM training usefulness were measured. Finally, lessons learnt from the case are presented.

Keywords-Service Desk; service management; IT service; incident management.

I. INTRODUCTION

The service desk is a crucial contact point between customers, users, IT service providers and third-party service providers. The service desk is responsible for carrying out incident management and request fulfillment processes. The main objective of the service desk is to restore normal service for users as quickly as possible. Because the service desk is located at the heart of the customer interface, it has a strong impact on customer satisfaction or dissatisfaction.

The service desk is known by many names such as help desk, support center, information center, IT solutions center or technical support. There are also call centers and contact centers that handle contact requests, service requests and complaints but they do not focus on providing specialist support for solving problems. The goal of IT service desk agents is to record, classify, diagnose and resolve service desk cases from customers and users. Service desk cases

can be incidents (e.g., software or hardware failures), service requests (e.g., requests for resetting passwords), complaints or feedback. Service desk engineers may also be responsible for identifying requests for a change (a request for change, RFC of an existing service or a feature in a service) or problems (causes of repeating incidents).

The service desk is often the most visible part of the IT organization. It is a function that is under continuous improvement and thus a very fruitful research target. This paper focuses on the improvement of the service desk both from a tool and process perspective. The paper is based on the previously published conference paper on service desk challenges [1]. This paper provides a wider literature review on service support and provides a more detailed case study description.

The IT service desk provides customers and users with support for using IT services. Information system and technology (IST) services can be broadly classified into four categories [2]: *Application services* are services that are delivered via software applications. *Operational services* maintain the IT environment such as installation services for hardware and software, change management, and trouble-shooting services and running the data centre. *Value-enabling services* increase the value of information assets (e.g., consulting, systems design, and help desk). Finally, *infrastructure services* focus on technical capabilities of IT infrastructure, such as capacity and security of IT assets. Customers aim to achieve certain business benefits by using the IT services. Therefore, if services are not available or there are many incidents that cause barriers for service usage, those business benefits may not be fully realized.

One of the most important tasks of the service desk is to effectively communicate with customers. This includes keeping customers and users informed on the progress of their support requests. Frequent communication usually means better customer service experiences. Shaw and Ivens

[3] define customer experience as an interaction between an organization and a customer. They describe the customer experience as "a blend of an organization's physical performance, the senses stimulated and emotions evoked, each intuitively measured against customer expectations across all moments of contact". One of the most interesting parts in their work is a customer experience pyramid with four sides: marketing, sales, service and support. Each area consists of building blocks: elements, sub-elements, standards, measures, targets, and improvements.

In the context of IT service management, the service desk is the interface of customer experience. Regardless of the maturity of IT service processes, sophistication of the ITSM tools and the skills and training of the service staff, customer experience in ITSM is provided by the service desk. The service can only be experienced by the customer through the service desk function of the IT service provider. Hence the service desk function must deal with "all" service requests coming through phone calls, the internet, email or in person [4]. The role of ITSM in this environment is not only to provide an effective customer experience but also a consistent one across all channels.

A. Related work

The service desk belongs to the services operation phase in the services lifecycle within services computing [5]. Many IT service provider organizations consider the improvement of IT service management processes as a difficult and challenging task. Typically, the process improvement is based on the processes and methods of the IT Infrastructure Library (ITIL). ITIL is the most widely used IT service management framework consisting of a set of best practices for managing IT services. One of the main benefits of ITIL is standardization of the customer support terminology. Lack of standardized terms and terminology differences cause problems for classifying support requests and communication between different service provider organizations.

The service management section of ITIL version 2 consists of two parts [6]: 1) Service Delivery (Service level management, IT financial management, availability management, capacity management, IT service continuity management) and 2) Service Support (service desk function, incident management, problem management, change management, configuration management and release management). ITIL version 3 emphasized the service lifecycle thinking and introduced five core books: Service Strategy [7], Service Design [8], Service Transition [9], Service Operation [10] and Continual Service Improvement [11]. The recent update as ITIL 2011 edition did not introduce radical changes to Service Operation processes. However, the Service Strategy book was completely rewritten.

In order to improve IT service management processes, organizations can use various IT service management frameworks, such as the Control Objectives for IT and related Technology (COBIT) framework [12], Microsoft Operations Framework (MOF) [13], Kapella's Framework for Incident Management and Problem Management [14], IT Service Capability Maturity Model [15] or IT service management standard ISO/IEC 20000 [16].

Several process improvement guidelines are available for improving IT service processes. Two of the most popular frameworks that support ITSM process improvement are Tudor's ITSM Process Assessment (TIPA) [17] that uses ITIL and the international standard for process assessment ISO/IEC 15504; and Standard CMMI Appraisal Method for Process Improvement (SCAMPI) [18] that can be used to improve organization's processes based on the model of CMMI for Services (CMMI-SVC). Moreover, Lahtela et al. [19] have explored how to measure IT service management processes for improvement in practice and discussed the value of real-time measurement information from IT service support processes.

Recently, there has been collaboration between the field of ITSM and process assessment in the International Organization of Standardization (ISO) publication. The ITSM standard ISO/IEC 20000 Technical Report Part 4 has been published showing how ISO/IEC 20000 requirements are translated into a process reference model (PRM) [20]. This model defines the ITSM processes in a life cycle described in terms of process purpose and outcomes along with an architecture describing the relationships between the processes [17]. Such a PRM is a requirement for a conformant assessment using a process assessment model (PAM) based on ISO/IEC 15504 [21]. A PAM provides a detailed model based on one or more PRMs for the purpose of assessing process capability [22]. The recently published Part 8 of standard ISO/IEC 15504 provides an exemplar process assessment model for ITSM [23]. The use of these standards can provide a useful tool to assess process maturity, performance and work products.

These frameworks are crucial to improve the underlying processes of the service desk, i.e., incident management and request fulfillment and the interfaces of these processes with other processes such as problem management and event management. A frequently asked question in IT service management is the differences between ISO/IEC 20000 standard, ITIL and COBIT frameworks and their role in process improvements within the function of service desk.

First, COBIT framework [12] is designed for IT management for governance purposes. COBIT 5 includes 37 governance and management processes that are categorized under five COBIT domains: Evaluate, Direct and Monitor; Align Plan and Organize; Build, Acquire and Implement, Deliver Service and Support; Monitor, Evaluate and Assess. Many of the ITIL processes can be easily found in the COBIT framework. For each process, COBIT defines the goal of the process, control objectives, process inputs and outputs, key activities, roles and responsibilities (usually

defined using RACI chart), metrics and a process maturity model. Goals and metrics have been divided into three groups: IT, Process and Activities. Managing Service Desk and Incidents is included in the COBIT framework in the Deliver, Service and Support domain.

While the COBIT format is very compact (4 pages for each process), ITIL provides detailed guidance on how to implement best practices. For example, ITIL v3 Incident Management [10] consists of 18 pages. For each process, ITIL describes process objectives; scope; value to business; policies, principles and basic concepts; process activities, methods and techniques; metrics; roles and responsibilities; critical success factors and risks.

ISO/IEC 20000 is an international standard for IT service management. It defines the auditable requirements for IT service management system. The standard consists of several parts with different purposes. ISO/IEC 20000-1 defines the mandatory (shall) requirements for a service management system. ISO/IEC 20000-2 Part 2: Code of practice for service management provides guidelines for interpreting the Part 1 requirement and addresses the recommended (should) approaches in implementing the service management systems. ISO/IEC TR 20000-3 Information Technology - Service Management - Guidance [24] helps in scope definition and applicability of ISO/IEC 20000-1.

There are several factors that might prevent an effective process improvement in the service desk. First, companies usually use external ITIL consultants to provide training for their employees. These consultants know the ITIL framework and IT service management concepts very well but have limited knowledge on the existing business concepts, methods, tools, services, and the structure of service desk groups. Second, inadequate or too complex IT service management tools may slow down any IT service management process improvement initiative.

Third, lack of process culture and process thinking is a very common phenomenon among IT companies. ITIL is a process oriented framework. Thus, the ITIL implementation team should be well-trained and have excellent process improvement and change management skills. Finally, lack of management support for ITSM project may cause an organization to not allocate sufficient resources for the process/tool improvement. Besides allocating enough resources for improvement work, management needs to motivate and reward people who pass the ITIL Foundation certificate exams and who participate in IT service management in their service support and delivery work activities in a consistent and structured manner as guided by the ITIL framework.

Improvement of the processes however represents only one aspect of service desk challenges. Bardhan et al. [25] state that IT services have aspects such as the high degree of involvement by people in delivery and that they are more or less intangible. Therefore, challenges of the service desk extend beyond the process view and include more subjective "people" aspects such as staff motivation and customer experience to generate business value. Simply put the service desk is the "face" of the IT services in an organization. It is required to be functioning effectively in order to raise the profile of IT in businesses. Hence overcoming the challenges of the service desk should be a key driver in service strategy of any organization.

There is a wide number of IT service management studies available. Previous studies on IT service management have put research efforts on success factors in implementing IT service management [26], [27], measuring ITIL implementation projects [28], implementation of service-oriented IT management [29], creating a taxonomy for ITIL processes [30], ITIL implementation maturity models [31], process maturity self-assessment [32], ITIL process integration architecture [33], and prioritization of service incidents [34].

Many studies have explored service management processes, such as improvement of incident management processes based on ITIL practices [35], creating a mature problem management process [36], service testing [37], service level management [38], change and configuration management [39] and release management challenges [40].

Sharifi et al. [41] present causes why ITIL implementations fail with some references to the service desk. They identify the following factors: spending too much time on complicated process diagrams, not creating work instructions, not assigning process owners, concentrating too much on performance, being too ambitious, allowing departmental demarcation and ignoring reviewing of the ITIL. Mohamed et al. [42] have integrated knowledge management elements to the IT service management providing a framework to attain effectiveness, efficiency and innovation during ITIL implementation in organizations.

There are also studies that have dealt directly with help desk activities such as a knowledge management-centric help desk [43]. Bruton [44] has identified ten key steps for managing the IT Help Desk. The service Desk encapsulates the services provided by the Help Desk. We analyzed the steps of Bruton [44] from the overall viewpoint of IT service management best practices. We list the ten steps for managing IT Help Desk from Bruton [44] and alongside provide our interpretation of evaluating the steps in terms of IT service management (in italics) using the ITIL framework with the focus on the service operation phase of the service lifecycle.

- **Know your resources**. Examine your resources to find out what you are capable of delivering and what you are not. Implement ways of improving your skills, equipment and contacts. *IT service management: In ITSM, knowing your resources is important. However, organizations should also take into account the capabilities required to deliver services. Resources and capabilities combine as Service Assets [6]. Resources are "consumed" as direct inputs for service delivery whereas*

capabilities represent the abilities required to manage resources [4]. Therefore, identifying and understanding performance of service assets is an important step for service management in general. Without the knowledge of resources and capabilities, there is no basis to define service value.

- **Know your customers**. Identify your customers, both users and non-users of your service and list them in order of priority. *IT service management: Differences between customers and users are clarified in the ITSM discipline. Customers and users are both important stakeholders in service management. Customers represent individuals or groups that "purchase" services which includes definition and agreement of service level targets. On the other hand, users "use" the services at an operational level and may be distinct from customers.*

- **Launch your services**. Launch a set of services that meets the majority of customers' needs. Encourage any customer who finds the services inappropriate to consider the service statement as merely a basis for negotiating a special service level agreement with them. *IT service management: Launching services refers to the service transition phase of the service lifecycle. However, planning for the services to be launched should be initiated during the service design phase in the service catalogue management process. Information on launched services should be available in the service catalogue. There may be two levels in a service catalogue: business level (designed for customers) and technical level (designed for service production teams).*

- **Manage the support workflow**. This requires establishment of effective workflow management in the support department. This should cover call management, query prioritization, job allocation, problem escalation and staff motivation. *IT service management: The key to managing a successful service support workflow is planning during the service design stage. Agreed service levels defined during the service level management process should ensure that the service delivery teams are confident in supporting the services. Service Level Agreements should be frequently reviewed to check whether they are consistently and accurately defined so that service level targets are achievable. After good planning, the most challenging areas in managing the incident workflow are incident classification and prioritization.*

- **Ensure good problem closure techniques**. It is not enough to solve the user's technical problem. Establish query closure methods to encompass ensuring customer satisfaction as well as analyzing recently completed jobs to see what lessons learnt can be extracted from how they were handled. *IT service management: In the ITSM, there are separate closing procedures for*

incidents and problems. In practice, this means that closing a problem may result in the closure of multiple incidents related to that problem. Problem management staff are responsible for maintaining the known error database before closing the problem so that future incidents and problems can be addressed in a more orderly fashion.

- **Instant workload status reporting**. Set up your reporting routines to provide instant snapshots of the current workload status as well as routine historical information. This will enable you to make decisions about how to deploy your resources. *IT service management: Modern ITSM tools enable a real time view of the resources that have been spent in the incident management and the number of the open/solved cases as well as performance measurement (average incident resolution and response time). Use of such metrics in the service desk function enables efficient resource consumption and optimizes service operations.*

- **Be proactive - take control**. Look for and implement ways of dealing with the workload proactively instead of just reactively. Don't let the workload control your department, you should control the work. *IT service management: Service management should focus on proactive work instead of reactive. This is one of the key benefits of implementing the ITSM model in the service organisation. Proactive actions are especially visible in the problem management process (major problem reviews, trend analysis, defining preventive actions) and in the Continual Service Improvement process (define what to measure, measure data, process data, analyse data and implement improvements continually). These actions ultimately facilitate the service desk to focus on the critical and urgent issues and eliminate the "fire fighting" attitude.*

- **Regular contacts with customers**. Communicate with your customers, through newsletters, workshops, knowledge provision, and most importantly, personal contact - get out there and mix. *IT service management: Communication plays a very important role in service management. The service desk is responsible for communicating incident resolutions, progress of the resolutions, and updated information on new and existing services. Communication can also occur in the form of service reviews, communicating Service Level Agreements and defining Service Level Requirements from the early stages to meet customer's expectations. The ITIL framework stresses consistent communication in every phase of the service lifecycle.*

- **Conduct surveys**. Establish ways of surveying your customers for their views on how the service is being delivered. Use this information to make improvements to your support service and always report your findings and your subsequent actions to your customers. *IT ser-*

vice management: This is consistent with the previous discussion about the value of communication in service management. Service management may involve several types of surveys: surveys after incident resolution or service request fulfillment or periodic customer satisfaction surveys. Besides customer surveys, employee surveys provide useful information on staff perception about service delivery and service bottlenecks. Reviews should be organized after service delivery, for example, after service deployment or after implementation of new or changed services. Survey results have to be analyzed so that it can be used as input for service improvements.

- **Redo all the above every 4 to 6 months**. Do not rest on your laurels no matter how good you are. Go back to step 1 every four to six months and review your whole set-up. *IT service management: Within service management, there is a continual service improvement phase in the service lifecycle based on Deming's Plan-Do-Check-Act cycle [11]. The Continual Service Improvement philosophy in service management encapsulates the entire service lifecycle from strategy to design to transition to service operation. Thus, the basic ideology is that the improvement of services, products, tools and processes should never stop applies in the service desk function as well.*

These ten steps can be used as a generic checklist while implementing or improving service desk activities. The number of academic studies published in the field of IT service management is rapidly increasing. However, many of them focus on presenting success factors or developing new features for the service management tools. More studies are needed to provide information on service desk improvement projects that have used IT Infrastructure Library as an improvement framework because the transition from a traditional help desk to a service-focused service desk typically involves many challenges.

B. Our Contribution

This paper is related to an IT service management research project Keys to IT Service Management and Effective Transition of Services (KISMET) conducted in Finland. The main contribution of this paper is to

- describe the strengths and challenges regarding IT service desk of Finnish Tax Administration,
- present how identified challenges were solved by using ITSM best practices,
- discuss ways to overcome service desk challenges as part of continual service improvement,
- explain how service desk performance and ITSM training usefulness were measured and
- provide lessons learnt from the case study.

The results of this study might be useful for service managers, service desk managers and IT service management process managers.

The remainder of the paper is organized as follows. In Section II, the research methods of this study are described. In Section III, service desk challenges and activities to improve the service desk are presented. Section IV is the analysis of findings. The discussion and the conclusions are given in Section V.

II. RESEARCH PROBLEM & METHODOLOGY

This case study is a part of the results of the KISMET project. The research problem of this study is: How could an IT service provider's service desk operations be improved by using IT service management best practices? The research problem was divided into the following research questions:

- What types of tools are used by the IT service desk workers?
- How are self-service methods used in the service desk?
- How has the service desk function been organized?
- What types of challenges exist in the IT service provider's customer support?
- How were these challenges solved by using service management best practices from the IT Infrastructure Library?
- What can be learnt based on IT service management training?

According to Yin [45], a case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context". Eisenhardt [46] defines case study research as "a research strategy focusing on understanding the dynamics present within single settings". The settings of this paper is the customer support environment of Tax Administration. A case study research method with a single case was used to address the research problem. Figure 1 describes the research settings of the case study. The study was carried out in Finnish Tax Administration's Kuopio unit.
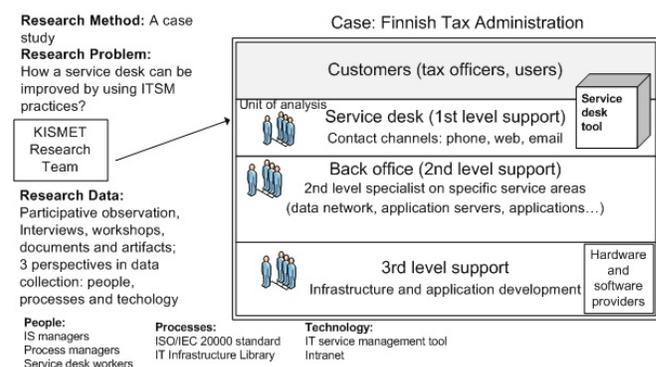

Figure 1. The research settings of the case study

A. The Case Organization and Data Collection Methods

Our case organization is the Information System Management unit of Finnish Tax Administration that provides

IT services (e.g., desktop services, service desk) to the tax administration staff. In Finland, taxation is carried out mainly by four organizations: Ministry of Finance, Tax Administration, Customs Finland and TraFi (Traffic safety agency). Tax Administration provides e-services for tax payers through the Tax.fi website. These services include tax card, revising the tax card, tax return online, notifications of changed bank account details.

In order to demonstrate the complexity of the IT service management, we present a short summary of Tax Administration's 12 organizational units. Each unit has its own special role in Finnish taxation:

- The Individual Taxation Unit (private customers, business owners and self-employed persons)
- the Corporate Taxation Unit (limited companies and corporate customers, customer information and tax control)
- the Tax Collection Unit (payment, collection, recovery and remittance of taxes and the tax account procedure)
- The Tax Auditing Unit (tax auditing activities as a part of tax control, tax audits, EU trade supervision and tax control duties).
- The Joint Services Unit (contact channels, language services ,tax risk management process, coordination of development projects and quality work)
- The IT Services Unit (responsible for application, production and ICT services; directs and oversees the use of ICT)
- The Administrative Unit (HR, financial and general administration tasks),
- The Executive and Legal Unit (Tax Administration's steering and management system),
- The Internal Auditing Unit (internal audits in Tax Administration)
- Communications Unit (communications and marketing)
- The Grey Economy Investigation Unit (producing and distributing information on the grey economy and action against it)
- The Tax Recipients' Legal Services Unit (the rights of tax recipients in taxation matters)

The Tax Administration organization had 5.300 full-time employees in 2011. The number of employees working in IT user support was 70. The organization used a phased approach for implementing service management processes. In the first phase, the focus was on incident management and the ITIL-based service desk service was launched in Spring 2011.

The case study was carried out in August 2011 - March 2012. In order to increase the quality of the case study, researchers used three important principles of data collection: 1) using multiple sources of evidence: three researchers participated in data collection from several sources 2) creating a case study datastore (a case study diary) 3) maintaining

a chain of evidence (linking observations to data sources). The following sources of evidence were used:

- Documentation from the case organization (e.g., incident management process description, service support metrics, ITSM tool user guide, service catalogue, service area, event management material, error handling guide).
- Archives (service classification schema, incident and service request records)
- Interviews/discussions (discussions in work meetings between a research team and the case organization, informal coffee table discussions with service support workers, email conversations with service managers, a focused interview on self service methods with an ITSM tool administrator)
- Participative observation (process improvement meetings and workshops (CSI workshop 27 September) and ITSM process training (45 minutes ITSM Introduction, 3 hour Basics of ITSM, ca. 70 participants) organized by the KISMET research team
- Physical artifacts: Service desk tool, intranet

B. Data Analysis Method

There are two main techniques to analyze case study data: a case comparison technique and a within-case technique. A within case analysis technique [46] was used in this study to analyze the collected case study data. The within-case analysis focuses on examining each case carefully as a stand-alone entity before making any generalizations. Additionally, researcher triangulation was used in data analysis. Three case study researchers participated in the data collection and analysis to obtain a richer view on the case organization's behavior. Instead of a formal database, we used Windows folder as a datastore for documents, memos, records and other material that we received from the case organization. The case study findings were validated in weekly meetings with the case organization. At the end of the research period, a case study report was sent to the case organization for validation.

III. TOWARDS AN IMPROVED IT SERVICE DESK

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. In this paper, we focus on the 'Perform a process assessment' and 'Process Improvement' phases.

A. *Perform a Process Assessment*

The process assessment focused on observing the current state of the service desk including process goals, inputs, outputs, roles and responsibilities, activities, metrics, and relationships to other processes. The assessement was not carried out as a formal process assessment but was based on ITIL v2 and v3 best practices and ISO 20000-1 requirements for incident management. The assessment was carried out by three ITSM researchers.

Strengths: During the study, we observed the following strengths regarding the service desk and customer support from an IT service management viewpoint:

- Many processes were described by using activity diagrams. Thus, it was easy to get overview of support practices.
- The organization had created an Incident Management process description (including inputs and outputs and process activities)
- The organization had a strong focus on continuous improvement of services (the performance of the service desk was measured with several metrics, frequent surveys were carried out to collect feedback both from customers and staff concerning service desk operations).
- Management support and commitment for improving IT service management was highly visible in the organization
- The selected service desk tool supported IT service management principles and a tool administration team had skills and was very motivated to improve the service desk tool based on service management practices.
- Service desk employees were really interested in receiving ITSM training. Some people who were not able to participate in ITSM training days asked whether they could get a short summary or personal training.

Potential improvement areas: The following improvement areas regarding the service desk and customer support were identified. These challenges (P= Process-related challenge, T= Tool-related challenge) should not be considered as weaknesses but as potential ways to make customer support more effective and service-focused.

- **Challenge:** Classification of support requests in the service desk requires clarification. (T) **Improvement suggestion:** Clarify the options in 'Reason for Contact Request' field of the incident record in the service desk tool. Make the difference between service requests and incidents visible. Service area and the type of support requests should be separate fields. Collect concrete examples of both incidents and service request for training purposes.
- **Challenge:** Customers are not able to classify support requests correctly. (T) **Improvement suggestion:** Remove the classification option from customers and simplify the submission of support requests.
- **Challenge:** It is difficult to identify repeating incidents from the service desk system (T). **Improvement suggestion:** Mark the repeating incidents (for example, create an additional 'check box' type data field to an incident record: Repeating incident = x). Use the 'Relate Cases' function to establish relationships between similar cases. Create a problem record based on a repeating incident.
- **Challenge:** The interface between incident management and problem management does not work. People do not understand the difference between incidents and problems. (P) **Improvement suggestion:** Train employees to open a problem record. Establish a simple-to-understand guidelines for problem management including triggers for problem management.
- **Challenge:** Service desk workers record several cases under one incident. (P) **Improvement suggestion:** Train service desk workers to record cases in such a way that one incident record includes only one issue.
- **Challenge:** Improvement ideas are not recorded systematically into the service desk system. (P) **Improvement suggestion:** Improvement ideas should be sent to a Continual Service Improvement team or Change Management team.
- **Challenge:** Lack of a formal Configuration Management Database (CMDB). (P, T) **Improvement suggestion:** Establish a Configuration Management process that is responsible for updating, maintaining and managing a Configuration Management Database (CMDB).

Customer support tools: Based on the interview with a service desk tool administrator (who also held a supervisor role in the Operations Bridge (OB); OB is responsible for observation and monitoring of the IT Infrastructure), we identified the following tools and applications that were used by customer support teams.

- A service desk tool (ITIL-compliant IT service management tool)
- A virtual phone system
- Screenshot application
- Office guidebook
- Information Board (a website of known problems)

A participative observation carried out by the research team revealed that besides the IT service management tool, a large amount of customer support information had been stored on the intranet sites. We found information on configuration items, change requests and problems and errors. This information was valuable for researchers because it showed how customer support practices are performed without ITIL. We expected that it might be difficult to persuade employees to give up the intranet based practices and use the IT service management tool instead.

Self-service methods: Based on interviews, we found out

that self service methods in the service desk included a knowledge base; Information Board (a website on known problems); customer portal that enabled 24/7 submission of incidents and service requests, as well as monitoring the progress of customer's own incidents and service requests. The information stored by customer support in the knowledge base includes short tips, advice, workarounds, and operational guidance (in the service desk's internal use).

B. Improving the IT Service Desk: Tools and Processes

This phase started when the research team asked the case organization which challenges they consider most important. In this section, we discuss how these challenges were solved. We focused the research efforts especially on four issues: improving the classification, defining the interface between incident and problem management, raising the awareness of IT service management through training, and improving the measurement of the service desk.

Because the time for research was limited, the process improvement started very soon from improving the classification. Based on discussions with IS management, a tool administrator, service support engineers and observations by researchers, the research team decided that support request classification required changes. There was a 'Reason for contact' field in the support request record. Overlapping categories (failure, error) were removed or renamed in the categories of the 'Reason for contact' field . The new categories included: incident (failure or error), request (feedback), request (improvement idea), request (order), request (other service request), request (advice), request (information/notification).

Additionally, the case organization's representatives asked whether the research team could improve the service area definitions. It was a challenge for a research team to explore the service areas and classify them into three tiers, because the number of service areas was large and researchers did not know the exact role and purpose of some service areas. The improved category tree was submitted to the case organization for validation. As an end result, a new service category tree was established (see Figure 2).

The second improvement area was related to defining the interface between incident and problem management processes. In the meeting (March 8th), there was a discussion on why incident management and problem management have to be separate processes. Two main benefits from having separate processes were identified. First, incident management can resolve cases faster by using workarounds from problem management. Second, problem management enables the detailed investigation of the case although the original incident has been resolved. The research team created a simple procedure for problem management. The procedure addressed how to use the ITSM tool to support the problem management process. The workflow from incidents and problems was explored using the scenario-based
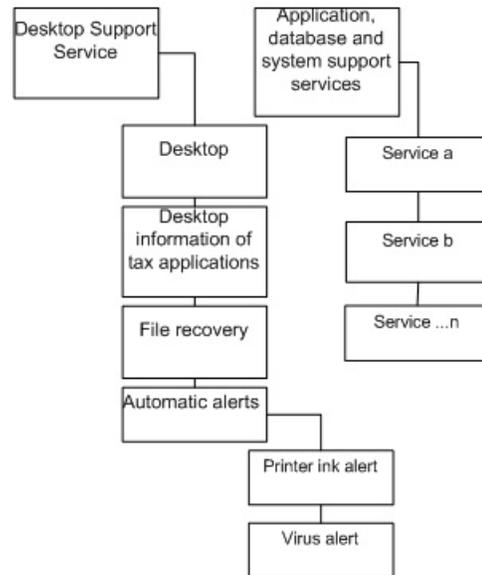

Figure 2.   A part of a service category tree

technique. We selected four real customer support cases, analyzed the workflow, and compared the handling procedure to an ITIL-based handling procedure. The improvement work also included the configuration and customization of a problem record (see Figure 3).
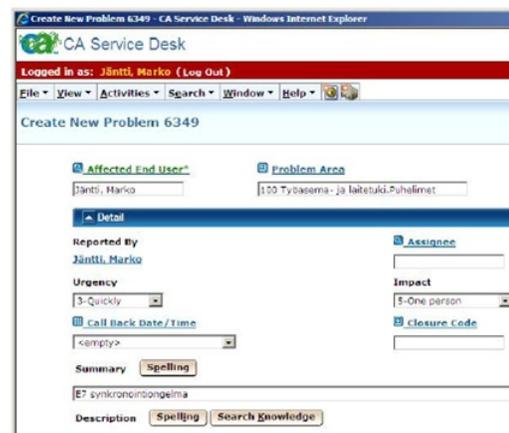

Figure 3.   A problem ticket

In the **Problem Management workshop** (February 21-22, 2012), the case organization decided to establish a problem management group that has responsibility to

- search cases that are potential problems
- model the problem management process in the User support services unit
- store essential configuration items to the service desk tool
- record known errors to the knowledge base.

The research team organized ITSM training in the case

organization in seven different locations. The following feedback (questions and comments) were collected from IT service management training sessions (Sep. 13th, Sep. 19th, Sep. 20th, Sep. 21th, Oct. 5th, Oct. 7th):

- "What is the current status of the service desk tool and the incident management process?"
- "How support requests should be classified and ITSM concepts integrated to the service desk?"
- "Which interfaces do service desk and incident management have?"
- "How IT service management training for service desk people should be conducted?"
- "What does continual service improvement mean for service desk?"
- "How do other organizations use ITIL?"
- "Is it possible to enable parallel handling of work tasks regarding one incident?"
- "How can incidents be connected to each other?"
- "It was difficult to adopt English ITIL terms, but after training, terms are much more clearer".
- "Service desk should see the big picture of customer support, for example, whether the issue is related to some existing problem?"
- "We have thought that process frameworks are only for managers. Now, it looks that they are coming to the field, too".
- "We should think about sending people to ITIL certification courses".
- "Support requests are complicated and manysided. Many service desk workers log cases incorrectly as problems if they can choose 'problem' from the contact type list".
- "ITILv2 looks like a blueprint of a French nuclear plant, it was really good that you (trainer) showed it in the end of the presentation".
- "Not every support group uses automatic alerts for support cases. It may happen that they do not know that they have received an incident or a problem".
- "The large number of customer support teams is a problem (routing cases between many teams increases the likelihood that the support case will be lost)".

After training, we collected feedback from employees how useful they considered IT service management training. Regarding the role of respondents, 14 were IT support engineers, 12 were designers, and 2 were management. The average of responses was 3.46 on a scale of 1 - not valuable at all, to 5 - very useful.

On March 12, the research team held an **IT service management measurement workshop** with the tool administrator to show the incident/service request listing in MS Excel format. The ratio between incidents and service requests was 114/304. The goal was to identify the differences between service requests and incidents. The tool

Table I
FEEDBACK FROM ITSM TRAINING: HOW USEFUL WAS THE TRAINING?
(N=28)

Grade	Description	Responses
1	Not valuable at all	1
2	Less than useful	2
3	Somewhat useful	12
4	Quite useful	9
5	Very useful	4

administrator reported that some cases include both the description of failure but also a request for more detailed investigation of the case. It was agreed that unclear cases shall be recorded as service requests. The research team had prepared Critical Success Factors, Key Performance Indicators and Metrics. The following ITIL metrics were selected as potential process metrics for the incident management process:

- Number of opened incidents
- Incident resolution time
- Incidents resolved within SLA targets
- Number of open incidents
- Call response time
- Customer satisfaction on resolved incidents
- Number of opened service requests

The measurement was considered an important part of Continual Service Improvement. The research team also studied whether service level agreements were used in the organization. We observed that there were no SLAs related to incidents in the operation. Another thing we observed was that prioritization of a case was not automatically based on urgency and impact of a case. This is one of the key requirements for incident management. The IT management listed the Service Level Management as a future improvement target.

IV. ANALYSIS

In this section, the analysis of results is presented. Results were categorized according to research questions. In order to maintain the chain of evidence, we describe the source for findings in parentheses (AR= Archives and records, D= Documentation, ID= Interviews and discussions, O= Observation, PA= Physical artefacts, ST= Seminars and training organized by the research group). Lessons learnt are presented after the analysis of each research question.

RQ1: What types of tools are used by the IT service desk workers? (PA, O, ID) Regarding the service desk, we observed during the study that the service desk tool supports the implementation of IT service management well. The tool was called a service desk tool although it

might have also supported many other support processes, because it was compatible with the concepts of the ITIL framework. **Lesson 1:** Although the improvement focus would be incident management, take other processes into account while defining the records in the ITSM tool. The self-service interviews and participative observation revealed the usage of tools, such as a virtual phone system, screenshot application, office guidebook, and information board. The information board was related to problem management because it seemed to store information on known problems. One important observation we made was that there were many datafields in the service desk tool that can be reused between different records (incidents, problems, requests for change) if carefully designed.

RQ2: How are self-service methods used in the service desk? (ID, AR) The organization had invested in automatizing the handling of service requests and electronic forms were well exploited in service request management. Many customer support workers were interested in using the knowledge base module of the IT service desk tool. This led us to define **Lesson 2:** Market self-service tools, such as a knowledge base, not only to customers and users but also to service desk workers. A well-designed and maintained knowledge base available to the service desk can remarkably decrease the incident resolution time. Typically, a self-service portal allowed customers to check the status of their support request and submit new incidents and service requests 24/7. Self-service tools are often considered too strongly as a customers' tool.

RQ3: How has the service desk function been organized? (O, I, D) The service desk and customer support were organized into three levels: Level 1 was responsible for resolving simple requests and incidents and routing more complicated requests to Level 2 that provided more advanced support, such application support for Tax applications etc.). Level 3 consisted of application development and hardware and software vendors as external stakeholders.

Lesson 3: Establish a group that promotes the problem management process and practices in the organization. Regarding incident management roles, we observed that roles and responsibilities and incident management activities were defined in the process description and followed the IT service management terminology. However, we noticed that there was no responsible person or a group for problem management. The organization had assigned a well functioning team (2-3 persons) for configuring the IT service management tool. Detailed process descriptions had been created for ITSM processes. Regarding the results, it has to be mentioned that the organization had focused on service desk and incident management in the first phase of the process improvement cycle (starting from Spring 2011). Therefore, the remaining ITSM processes, such as change management and problem management, were immature.

RQ4: What types of challenges exist in the IT service

provider's customer support? (AR, PA, O, ID, D, ST) Many of the challenges seemed to be related to classification of support requests. Service desk workers indicated both in training and in discussions that users and customers have problems in classifying requests. However, nobody had measured the number of incorrectly classified requests.

Lesson 4: Train customer support workers in the early phase to use the 'problem' concept correctly and to identify problems. Based on the knowledge from our previous studies, it was not a surprise that the organization experienced difficulties with problem management. This challenge has been noted also in our previous studies. Some service desk workers had classified a case as a "problem" when the problem was one of the options in Reason for Contact field. Crucial for problem management would be recording information on which incidents are repeating incidents and thus sources of problems. Discussions in training also indicated that some service desk teams were interested in identifying and flagging repeating incidents.

Lesson 5: Establish clear escalation rules and automatic email alerts on new support cases. Comments from ITSM training and participative observation also revealed that incident escalation and routing involves challenges, for example, all teams do not use automatic alerts that send a message to email that they have received a new case. There was also a need to parallel handling of incident tasks in order to accelerate the resolution process.

RQ5: How were customer support challenges solved using service management best practices from the IT Infrastructure Library? (AR, PA, O, ID, D, ST) Creating an effective measurement framework for IT service management is a difficult task. Measurement is visible especially in the ITIL Continual Service Improvement (CSI) book that provides guidance on measuring IT services.

Lesson 6: Establish a CSI process and define the relationship between Measurement activity, Reporting activity and Managing Improvement Ideas activity. Customizing the ITIL CSI is not an easy task because the ITIL CSI does not provide a clear process description or a process diagram. CSI consists of three main areas: measurement, reporting and management of improvement ideas. We organized two workshops related to measurements: a CSI workshop that increased the employee's awareness of CSI practices and a measurement workshop that focused on selecting appropriate process metrics. The problem with some ITIL based metrics was that they were described with complex terminology. There were some metrics the implementation of which would have needed changes to the service desk tool, such as the number of incidents reopened and as a percentage of the total. Regarding the service desk, we observed that there were over 10 metrics. Additionally, we observed the case organization needed a model of how to handle service improvement ideas in a more systematic way. One possibility would be to assign development ideas to the change

management team that would open a Request for Change.

Lesson 7: Separate configuration item, the contact request type, and the service area from each other in order to enable reuse of categories. After examining the service desk tool and incident classification rules the research team suggested to the case organization that the service area requires changes and that the using the service desk system should be as simple as possible for customers. Our solution was to separate a configuration item, the contact request type, and the service area from each other. This solution enabled reusing of service area and configuration items in other records, such as in Request for Change and Problem records.

Lesson 8: Start building the CMDB from the most frequently used configuration items, such as applications, operating systems, and desktops. While investigating the incident classification in the service desk tool, we observed that the interface between incident management and configuration management requires clarification. This led us to define a preliminary model of how to store information on configuration items (CIs). We created a table with three columns: CI Family, CI Class and CI Name and started from application CIs. The result was Software Family, 8 CI application classes (for example, Office application, administration application, access management application) and CI names (MS Word). We continued the validation of the CI model by selecting incidents randomly from the service desk tool and exploring which CI the incident is related to and whether the CI is defined in our model.

RQ6: What can be learnt from IT service management training (ST) Service management training serves two main purposes. First, it helps managers to decrease the employees' change resistance to new IT service management terms and processes "...It was difficult to adopt English ITIL terms, but after training, terms are much more clearer...". Additionally, organizing continuous ITSM training is the only way to ensure that ITSM practices are really adopted by the organisation's employees. **Lesson 9:** ITSM training helps to decrease change resistance to ITSM. We observed that after training, some employees seemed to be ready to recommend ITSM principles to their colleagues and were interested in receiving more ITSM training. Training increases the employees' awareness on the objectives and benefits of ITSM implementation and may act as a reminder that employees are also responsible for service management "...We have thought that process frameworks are only for managers. Now, it looks like they are coming to the field, too ...". Employees participate more in the training discussions when they find their own position in the ITSM framework. Usually, service desk employees discuss more in ITIL training than programmers, but why? Is the reason that service desk and incident management are more visible in ITIL than application development? A rival explanation would be that service desk workers are more social than programmers and

tend to speak more than programmers.

Second, IT service management training is a valuable source of improvement ideas. This leads to our final lesson **Lesson 10:** ITSM training helps to identify improvement targets. Questions and comments during ITSM training often reveal bottlenecks, challenges and unclear ITIL issues. For example, in our case, ITSM training provided valuable information on improvement areas, such as interfaces between the service desk and other ITSM processes, for example, between incident management and configuration management, change management, and event management. We learnt that face-to-face training resulted in much more discussion compared to remote training, and observed that small training groups (less than 10 people in a group) work very well in Awareness training because people are not afraid of asking questions.

V. DISCUSSION AND CONCLUSION

The service desk plays a very important role in IT service management because it is responsible for daily communication with customers and users. In the IT Infrastructure Library, the service desk is a function that performs the incident management process. This paper aimed to answer the research problem: How could an IT service provider's service desk operations be improved by using IT service management best practices? The main contribution of this study was to explore 1) service desk tools, 2) self-service methods, 3) structure of the service desk function, 4) challenges related to the service desk and customer support and 5) solutions to these challenges based on ITSM practices.

The case organization Finnish Tax Administration was a representative case of a government agency that is implementing service management based on ITIL. The key challenges we identified in service desk operations were related to classification of support requests both from the service desk workers' viewpoint and customers' viewpoint, understanding the differences between incident and problem management processes, and identifying the sources of problems and interfaces between IT service management processes.

The study also presented solutions to identified challenges. Regarding classification of requests and incidents, an improved service category tree was established and categories of the Reason for Contact field in the incident record were clarified. Regarding the interface between incident and problem management, a customized problem record was created, a simple problem management procedure created, and the problem management group created. The improvements on ITSM measurement practices included selection of incident management metrics and two workshops (CSI workshop and Measurement Workshop). Additionally, ITSM training was organized for the case organization's employees. Feedback from training was presented in this paper as

well as comments and questions that participants asked during training. Data were analyzed according to the research questions and lessons learnt from researchers' viewpoint were presented as a part of the analysis.

This case study included certain limitations. First, regarding internal validity, data were collected using qualitative research methods. Quantitative methods, such as a customer satisfaction survey on service desk could have provided a richer view on the organization. However, the qualitative case study method is well-suited to research business process-related challenges in organizational context. Additionally, we used a rich set of data sources and three researchers to build a detailed view of the organization and its customer support.

Second, concerning case selection and external validity, the case organization was a partner of the software engineering unit's research project. Thus, convenience sampling was used as a sampling strategy. It is a generally accepted way to obtain case organizations. Third, this study included one service area of the case organization. A larger number of cases and comparison between them based on the preselected categories would have increased the quality of case study. This study can act, for example, as a pilot case study for further studies. During the study we identified several targets for further research. Further research could explore, for example, the role of social media in service desks, impact of service desk improvements on the business, or IT service management process assessment tools.

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REFERENCES

[1] M. Jäntti, "Examining challenges in it service desk system and processes: A case study," in *Proceedings of the 7th International Conference on Systems 2012 (ICONS2012)*. CPS Publishing, 2012, pp. 105–108.

[2] J. Peppard, "Managing it as a portfolio of services," *European Management Journal*, vol. 21, no. 4, pp. 467–483, August 2003.

[3] C. Shaw and J. Ivens, *Building Great Customer Experiences*. Palgrave-Macmillan, 2005.

[4] P. Bernard, *Foundations of ITIL*. Zaltbommel, Netherlands: Van-Haren Publishing, 2012.

[5] L.-J. Zhang, J. Zhang, and H. Cai, *Services Computing*. Tsinghua University Press, Beijing and Springer-Verlag GmbH Berlin Heidelberg, 2007.

[6] Office of Government Commerce, *ITIL Service Delivery*. The Stationary Office, UK, 2002.

[7] Office of Government Commerce(a), *ITIL Service Strategy*. The Stationary Office, UK, 2007.

[8] Office of Government Commerce(b), *ITIL Service Design*. The Stationary Office, UK, 2007.

[9] Office of Government Commerce(c), *ITIL Service Transition*. The Stationary Office, UK, 2007.

[10] Office of Government Commerce(d), *ITIL Service Operation*. The Stationary Office, UK, 2007.

[11] Office of Government Commerce(e), *ITIL Continual Service Improvement*. The Stationary Office, UK, 2007.

[12] COBIT 5, *Control Objectives for Information and related Technology: COBIT 5*. ISACA, 2012.

[13] Microsoft, "Microsoft operations framework," http://technet.microsoft.com/en-us/library/cc506049.aspx, December 2012.

[14] V. Kapella, "A framework for incident and problem management," International Network Services whitepaper, 2003.

[15] F. Niessinka, V. Clerca, T. Tijdinka, and H. van Vliet, "The it service capability maturity model version 1.0," CIBIT Consultants&Vrije Universiteit, 2005.

[16] ISO/IEC 20000, *IT Service Management, Part 1: Specification for service management*. ISO/IEC JTC1/SC7 Secretariat, 2005.

[17] B. Barafort, V. Betry, S. Cortina, M. Picard, M. St-Jean, A. Renault, and O. Valdes, *ITSM Process Assessment Supporting ITIL*. Zaltbommel, Van Haren Publishing, 2009.

[18] CMMI, *Standard CMMI Appraisal Method for Process Improvement (SCAMPISM) A, Version 1.3: Method Definition Document*. USA: Software Engineering Institute, Carnegie Mellon University, 2011.

[19] A. Lahtela, M. Jäntti, and J. Kaukola, "Implementing an itil-based it service management measurement system," in *Proceedings of the 4th International Conference on Digital Society*. St. Maarten, Netherlands Antilles: IEEE Computer Society, February 2010, pp. 249–254.

[20] ISO/IEC, *TR 20000-4:2010 - Information technology - Service management - Part 4: Process Reference Model*. Geneva, Switzerland, International Organization for Standardization, 2010.

[21] A. Mesquida, A. Mas, E. Amengual, and J. Calvo-Manzano, "It service management process improvement based on iso/iec15504: A systematic review," *Information and Software Technology*, vol. 54, no. 3, 2012.

[22] ISO/IEC 2004, *ISO/IEC 15504-2:2004 - Information technology - Process Assessment - Part 2: Performing an Assessment*. Geneva, Switzerland, International Organization for Standardization, 2004.

[23] ISO/IEC TS 15504-8:2012(E), *Information technology - Process assessment -Part 8: An exemplar process assessment model for IT service management.* ISO/IEC TC JTC1/SC7 Secretariat, 2012.

[24] ISO/IEC, *ISO/IEC TR 20000-3 Information Technology - Service Management - Guidance on scope definition and applicability of ISO/IEC 20000-1.* ISO/IEC JTC1/SC7 Secretariat, 2010.

[25] I. Bardhan, H. Demirkan, P. Kannan, R. Kauffman, and R. Sougstad, "An interdisciplinary perspective on it services management and service science," *Journal of Management Information Systems*, vol. 26, no. 4, pp. 13–64, 2010.

[26] W.-G. Tan, A. Cater-Steel, and M. Toleman, "Implementing it service management: A case study focussing on critical success factors," *Journal of Computer Information Systems*, vol. 50, no. 2, 2009.

[27] C. Pollard and A. Cater-Steel, "Justifications, strategies, and critical success factors in successful itil implementations in u.s. and australian companies: An exploratory study," *Information Systems Management*, vol. 26, no. 2, pp. 164–175, 2009.

[28] J. Iden and T. R. Eikebrokk, "Understanding the itil implementation project: Conceptualization and measurements," in *Proceedings of 2011 22nd International Workshop on Database and Expert Systems Applications.* Washington, DC, USA: IEEE, 2011.

[29] A. Hochstein, R. Zarnekow, and W. Brenner, "Itil as common practice reference model for it service management: Formal assessment and implications for practice," in *EEE '05: Proceedings of the 2005 IEEE International Conference on e-Technology, e-Commerce and e-Service (EEE'05) on e-Technology, e-Commerce and e-Service.* Washington, DC, USA: IEEE Computer Society, 2005, pp. 704–710.

[30] M. Brenner, "Classifying itil processes; a taxonomy under tool support aspects," in *Business-Driven IT Management, 2006. BDIM '06. The First IEEE/IFIP International Workshop on*, april 2006, pp. 19–28.

[31] R. de Sousa Pereira and M. da Silva, "A maturity model for implementing itil v3," in *Services (SERVICES-1), 2010 6th World Congress on*, july 2010, pp. 399 –406.

[32] R. Meziani and I. Saleh, "e-government: Itil-based service management case study," in *Proceedings of the 12th International Conference on Information Integration and Web-based Applications & Services*, ser. iiWAS '10. New York, NY, USA: ACM, 2010, pp. 509–516.

[33] S. Zhang, Z. Ding, and Y. Zong, "Itil process integration in the context of organization environment," in *Computer Science and Information Engineering, 2009 WRI World Congress on*, vol. 7, 31 2009-april 2 2009, pp. 682–686.

[34] J. Barlow and P. Stewart, *Branded customer service: the new competitive edge.* United States of America: Berret-Koehler Publishers, Inc., 2004.

[35] M. Jäntti, "Lessons learnt from the improvement of customer support processes: A case study on incident management," in *Product-Focused Software Process Improvement*, ser. Lecture Notes in Business Information Processing, W. Aalst, J. Mylopoulos, N. M. Sadeh, M. J. Shaw, C. Szyperski, F. Bomarius, M. Oivo, P. Jaring, and P. Abrahamsson, Eds. Springer Berlin Heidelberg, 2009, vol. 32, pp. 317–331.

[36] M. Kajko-Mattsson, "Problem management maturity within corrective maintenance," *Journal of Software Maintenance*, vol. 14, no. 3, pp. 197–227, 2002.

[37] M. Jantti and T. Kujala, "Exploring a testing during maintenance process from it service provider's perspective," in *Information Science and Service Science (NISS), 2011 5th International Conference on New Trends in*, vol. 2, oct. 2011, pp. 318–323.

[38] M. Kajko-Mattsson, C. Ahnlund, and E. Lundberg, "Cm3: Service level agreement," in *ICSM '04: Proceedings of the 20th IEEE International Conference on Software Maintenance.* Washington, DC, USA: IEEE Computer Society, 2004, pp. 432–436.

[39] C. Ward, V. Aggarwal, M. Buco, E. Olsson, and S. Weinberger, "Integrated change and configuration management," *IBM Syst. J.*, vol. 46, pp. 459–478, December 2006.

[40] 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.

[41] M. Sharifi, M. Ayat, A. A. Rahman, and S. Sahibudin, "Lessons learned in itil implementation failure," in *Information Technology, 2008. ITSim 2008. International Symposium*, vol. 1, aug. 2008, pp. 1–4.

[42] M. Mohamed, V. Ribiere, K. O'Sullivan, and M. Mohamed, "The re-structuring of the information technology infrastructure library (itil) implementation using knowledge management framework," *The Journal of Information and Knowledge Management Systems*, vol. 38, no. 3, pp. 315–333, 2008.

[43] L. M. Gonzalez, R. E. Giachetti, and G. Ramirez, "Knowledge management-centric help desk: specification and performance evaluation," *Decis. Support Syst.*, vol. 40, no. 2, pp. 389–405, 2005.

[44] N. Bruton, *How to manage effective IT Help Desk.* Butterworth Heinemann, 2002.

[45] R. Yin, *Case Study Research: Design and Methods.* Beverly Hills, CA: Sage Publishing, 1994.

[46] K. Eisenhardt, "Building theories from case study research," *Academy of Management Review*, vol. 14, pp. 532–550, 1989.