Smart Tools for IT Service Management:

A review of two decision support system projects

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Abstract

This paper reports on two recent research projects that addressed practical management problems in the discipline of IT service management (ITSM). We highlight the growing importance of software-mediated tools to improve ITSM processes and review two recent projects that designed decision support tools for ITSM. From the use of prior literature, rigorous methods and empirical evidence, contributions are made to Information Systems theory and ITSM practice. Although different theories and methods guide the two research projects, a common theme of engaged management scholarship is demonstrated through the successful application of industry relevance in managing the multi-disciplinary academic research projects. Outcomes from the projects of this nature demonstrate exemplary cases of success stories where the primary research objective is to develop innovative solutions that work in practice and are grounded in academic rigour.

Introduction

An increasing number of organisations are turning to the IT service management (ITSM) model to adopt a more customer-focused and service-oriented approach in response to external factors such as regulation, competition, customer requirements, market pressures and economics. ITSM is a process-focused discipline for managing IT as services that deliver value to customers. The model, in essence, de-emphasizes the management of technology and IT systems and instead focuses on the provision of a collection of end-to-end IT services to support the business of the organisation (Cater-Steel et al. 2013). Not unexpectedly, the increasing popularity of ITSM is accompanied by a proliferation of software tools to support processes such as incident management and configuration management.

The aim of this paper is to highlight the growing importance of software-mediated tools to improve ITSM decision making and processes. We review two recent industry-based projects that designed decision support tools for ITSM. The project teams included doctoral candidates who have practitioner's knowledge in ITSM and are trained in research methods to work in the projects. The two research projects aim to address the problem of the lack of practical relevance in the research outcome evident in the Information Systems discipline despite being an industry-driven field (Rosemann & Vessey 2008). We demonstrate these two projects as exemplary cases of engaged management scholarship where challenging

industry problems were resolved using academic research methods in order to provide concrete solutions, and at the same time contribute to the body of knowledge in the literature.

The paper is structured as follows. Recent research on ITSM and the development of supportive software tools is reviewed. Each of the selected projects is then described in detail. The discussion compares and contrasts the projects. Finally, the conclusion provides a summary, discusses contributions and limitations, and suggests future research directions.

Literature Review

To provide guidance for implementing the ITSM model many organisations use the IT Infrastructure Library (ITIL®) framework. ITIL was initiated by the UK Office of Government Commerce in the late 1980s. Since then ITIL has undergone several revisions and has now become a primary source of ITSM best practice. Under the influence of the internationally active IT Service Management Forum (itSMF) the framework has gained worldwide acceptance among private as well as public sector organisations (Barafort, Di Renzo & Merlan 2002; Clacy & Jennings 2007; Galup et al. 2009; Hochstein, Zarnekow & Brenner 2005). Research carried out in Australia, Europe, US and South Africa has confirmed that organisations have benefited from adopting the framework (Cater-Steel & McBride 2007; Hochstein, Tamm & Brenner 2005; Potgieter, Botha & Lew 2005; Tan, Cater-Steel & Toleman 2009). The ITIL phenomenon led to the creation of the BS 15000 standard which later evolved into the international ISO/IEC 20000 standard for IT service management (ISO/IEC 2011). Since its publication, ISO/IEC 20000 has provided organisations with a set of requirements for the audit and third party certification of the quality of their ITSM processes.

The incident management process is one of the most widely adopted, and often one of the first ITIL processes implemented by organisations (Marrone et al. 2014). Although ITIL-supported tools are available to provide basic functions to log and track incidents, it is not surprising that researchers have sought to develop more sophisticated tools to specifically support this process. For example, Cusick and Ma (2010) defined an approach to improve responses during an incident, aiming to improve and refine the treatment of the incident through the use of appropriate tools. The approach was tested in a division (Corporate Legal Services) of an international firm Wolters Kluwer (WK). The researchers concluded that the approach was totally adherent to ITIL, proved to be very efficient, and realized the need to apply the approach to other methods and practices. Jäntti (2009) analysed the system requirements for incident management in accordance with ITIL processes. The requirements included requisition; status checking of the request; knowledge base, single contact point; and keeping records within the time limits defined in the SLA (Service Level Agreements). Tehrani and Mohamed (2011) considered a knowledge management approach was important for Service Desk tools and developed an ITIL-based tool to assist incident management. They applied the Case Based Reasoning technique in the ITIL-based tool.

Most organisations implementing ITSM principles rely on a configuration management database (CMDB). As well as storing up-to-date details of current software, hardware and communication items, a CMDB records the relationships between configuration items. This information is crucial to plan for changes to hardware, software and networks, to restore service after an incident, and to solve problems. CMDBs provide support at the operational level of ITSM.

Recently, the potential contribution of decision support systems has become widely considered to enhance the decision making processes of managers and operational-level staff. The decision making process requires both knowledge and information. The knowledge management process involves gathering, analysing, storing, and sharing knowledge and

information within the organisation (Phifer 2011). Information provides clues to resolve an uncertainty and complexity of an issue, while the knowledge helps in understanding the ambiguity around the issues. A decision support system aids in decision making under the conditions of uncertainty and complexity (Zack 2004).

Research method

The methodology used to compile this research paper was based on narrative inquiry with reflective processes as an effective means to document the experiences of the leaders of the two research projects. The narrative inquiry approach entails the documentation and analysis of accounts of a specific domain of discourse, allowing the research participant to tell his or her own story (Hunter 2004). Narrative inquiry has been used previously in Information Systems research, for example by Hunter and Tan (2001) to identify the major career path impacts of IS professionals, and by Cater-Steel, Zarnekow and Wulf (2011) to compare different approaches to ITSM education.

As academics, we are encouraged to use reflective practice to prompt considered actions to enhance our teaching and research (Fry, Ketteridge & Marshall 2009). This research was motivated by our desire to improve future ITSM industry-research projects. After agreeing on the format of the narratives based on summaries of published research articles, each author individually prepared their account of the ITSM project they led. We then reviewed the narratives and discussed and refined them to compare and contrast the approaches and outcomes. Each of the authors then had a subsequent opportunity to review and comment on the narratives. Through this process we were able to gain deeper understanding of the relative benefits and drawbacks to the approaches that were undertaken.

This paper reviews two recent projects that focus on the design of decision support tools for specific aspects of ITSM. For each project, the background for the project is provided, including a review of relevant literature. This is followed by the research questions, research approach and methodology. The design, development, testing and evaluation of each tool is then described.

Case A – Decision Support Recommendation System (DSRS) for IT Service Operation

IT Service Operation

ITIL provides a framework for IT service operations and infrastructure while CMMI (capability maturity model integration) provides a set of improvement goals and a point of reference for appraising current processes. Both CMMI and ITIL improve IT service processes as they could be used together to improve IT service quality and decrease the cost of service operation. IT supports process reengineering as an ongoing process, which requires a continuous monitoring of the KPIs at an operational and tactical level. A dashboard with targets signals as green light, yellow light, and red light can be established for each KPI. Recent advancements in telecommunications and computer networking technologies are able to integrate any distant and disparate systems together, making it possible to control a remote system from anywhere, based on decisions made in effective management of IT service support process (Talla & Valverde 2013). The objective of this research case is to propose a decision support recommendation system (DSRS) tool for effective management of all key performance indicators (KPIs) of IT service support processes and an on-going reengineering of IT service support processes for improved quality of support, at a reduced cost (Valverde, Saade & Talla 2014).

Case Study Research Method

A case study methodology was chosen to emphasize and explore factors identified by the ITIL framework (Benbasat, Goldstein & Mead 1987).The case study approach subsequently allowed us to identify directions for further investigation. This approach is commonly used as a qualitative method for research in the information systems field. The research in Benbasat, Goldstein and Mead (1987) suggested the following three reasons that the case study approach is suitable for information systems: the researcher can study the information system in its natural setting; the researcher can answer "how" and "why" questions; and the case study approach is suitable for studies in which little formal research has been conducted previously.

The case study selected was that of an IT services company located in Liverpool, UK. The selected company provides several types of support services to many organizations in the UK. For the research project, we selected a company that specializes in dental care. The case entails ten dental clinics in different locations of Liverpool. All these clinics are connected via a high-speed Wide Area Network (WAN). The data is centralized into the IBM RS6000 server located in the main dental center. Workstations are located in the user office and they are connected through the same network as well.

The case is explained by elaborating on the dental clinic organisational structure, main business services and client base. Since data gathering is an important part in case study research, we used the work of Stake (1995) and Yin (1994) who identified seven sources of empirical evidence for case studies, as listed in Table 1.

Source of Evidence	**Description and Examples**
Documents	Written material sources that include published and unpublished documents, company reports, memos, letters, agendas, administrative documents, departmental info, reports, e-mail messages, newspaper articles, or any document that presents some evidence of some information.
Archival records	Service records, organisational records, lists of names, survey data, and other such records.
Interviews	An interview can be used for three purposes: as an exploratory device to help identify variables and relations; as the main instrument of the research; and as a supplement to other methods.
Questionnaires	These are structured questions written and supplied to a large number of respondents, commonly spread over a large geographical area for consideration in advance. Respondents fill in the blank spaces and return the questionnaires to the researcher either by post or in person. Sometimes incentives, such as a small gift, are used to encourage recipients to complete the questionnaires.
Direct observation	This occurs when a field visit is conducted during the case study. This technique is useful for providing additional information about a topic being studied. Reliability is enhanced when more than one observer is involved in the task.
Participant-	Participant-observation turns the researcher into an active

observation	participant in the events being studied
Physical artefacts	Physical artefacts can be tools, instruments, or some other physical evidence that may be collected during the study as part of the field visit. Use of a number of these instruments to obtain data from the same source provides for *triangulation* as defined in Brenner (2006).

Table 1. Sources of Empirical Evidence

In this project, questionnaires, review documents, archival records and observations were used to collect data for the project.

The information system research approach was used in this project, based on the method described by Burstein and Gregor (1999). They demonstrated the importance of recognizing the "System Development" approach and relevant criteria for guiding the validity and worth of such work. Following the "System Development" approach from Burstein and Gregor, Figure is used.

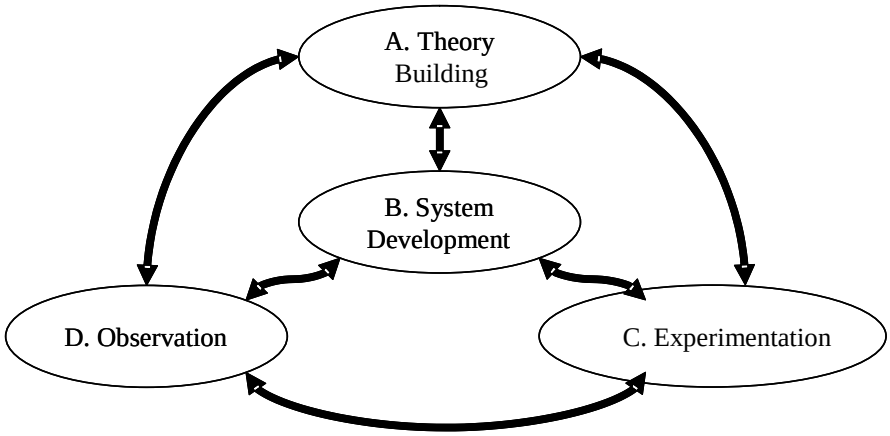

Figure 1. Information system research to phenomenon of interest

This form of research can be regarded as action research which is suitable for this project because "System Development" recognises other research fields next to system development, supports rapidly changing environments, the use of the prototype as the natural way of approach.

The process is iterative, i.e., the cycle of action and reflection continually generates new insights. Area A in Figure is the theory building phase, which is presented in the literature review, and area B is the development and design of a general system for the proposed DSS. Area C is about the implementation of the DSS prototype at a case study organisation. The prototype is based on theory building and the system development where underlying models are researched and applied in the system. Also information from the observation area D can be useful. For all areas, this is an iterative process where new findings can be added to the system. Area D is important to study the impact of changes in technology and systems in the organisation. These studies will generate new knowledge and improve acceptance of the system under construction. This area D can deliver useful information for the theory building, system development and the experimentation area.

Tool design & development

A decision support system (DSS) tool can be focused on providing recommendations specific to a problem domain such as IT service support. Therefore, a specialized DSS such as a recommendation system entails the manipulation of multiple attributes with a proper combination of data structure and scientific methodology vital to successfully achieve its goal. In effect, the recommendation system takes the form of a typical DSS with database, knowledge-base and inference components.

Figure 2 shows the architecture of the proposed DSS, implemented as a decision support recommendation system that has an interface with query processing capabilities and a dashboard; an inference engine for logic/algorithm computations; and the databases composed of the knowledge and operational data.

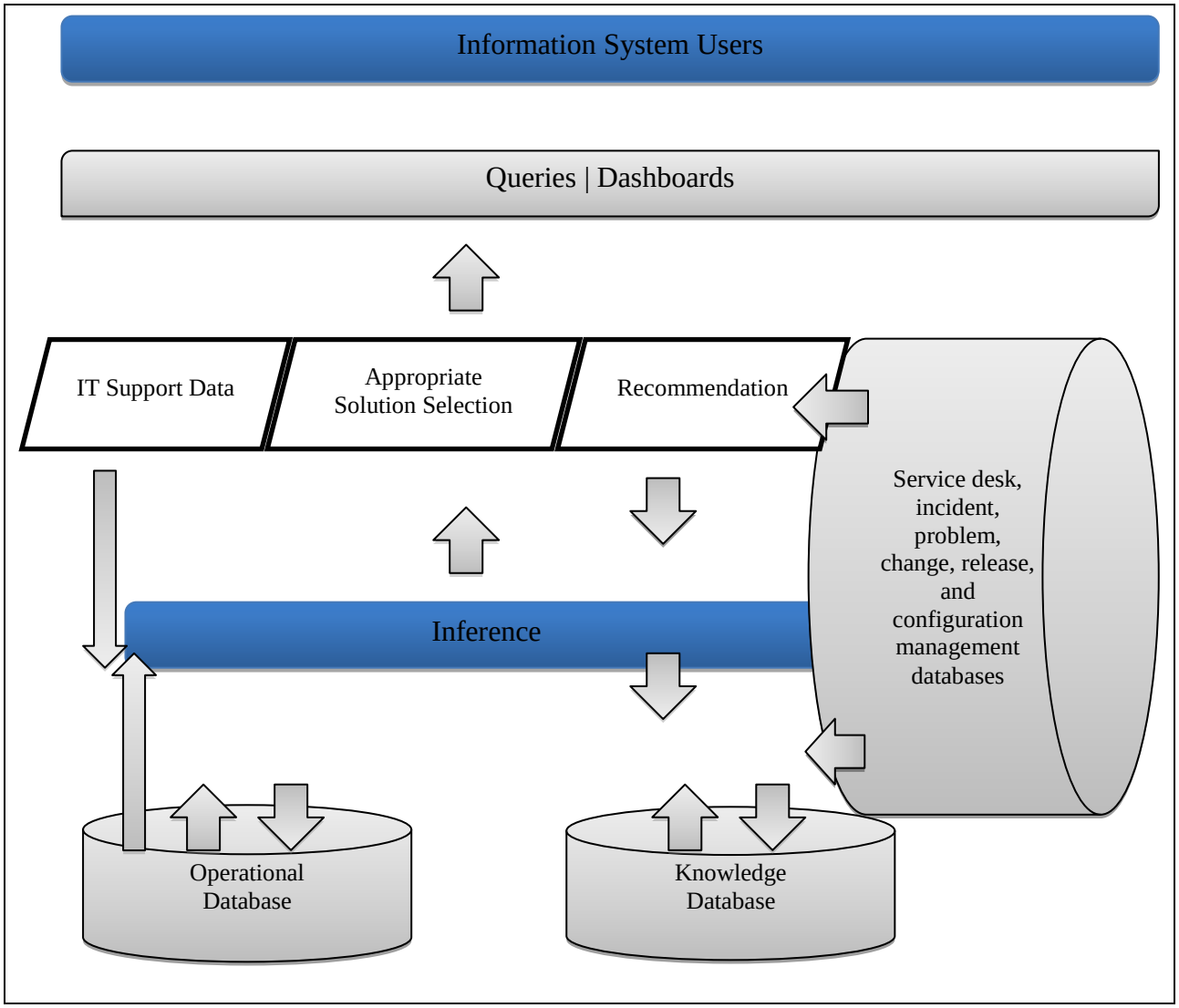

Figure 2. Architecture of a Decision Support Recommendation System

Any collaborative filtering system such as the one used at the query and dashboard layer must rely on a substantial database of users' past actions (questions, incident reports, conflict resolution outcomes, ratings, etc.) in order to find the similarities and differences between them and a given user. In our proposed architecture this would translate into a database of

users' portfolios. Using methods from the recommendation system's body of knowledge, the process of using the DSRS would entail five primary steps as shown in Figure 2:

1. In order to generate initial recommendations, an assessment form of the current state of affairs needs to be included. This form would include some logic to provide a score.
2. Based on the score obtained, the system generates initial user support suggestions. This represents a filtering method, since in the beginning the users hold no portfolio of support requirements. The users are able to view available query and support threads, thereby further filtering them according to various preferences and usage criteria.
3. Once the information of a number of support services have been logged, the collaborative filtering mechanism starts making recommendations.
4. In doing so, it starts to form the neighbourhood of *n* similar user-problem sets with "similar" service support requests. Similarity can then be calculated based on Jaccard index. The procedure further examines the portfolios of the user-problems-solution sets in the same neighbourhood and counts the frequencies of the support services.
5. The service support user-problem with the highest frequencies of occurrences is then presented to the service desk clerk/professional/user as a recommendation to the service support request.

The clerk/professional/user may choose among or make other selections from the ones not explicitly recommended to him/her.

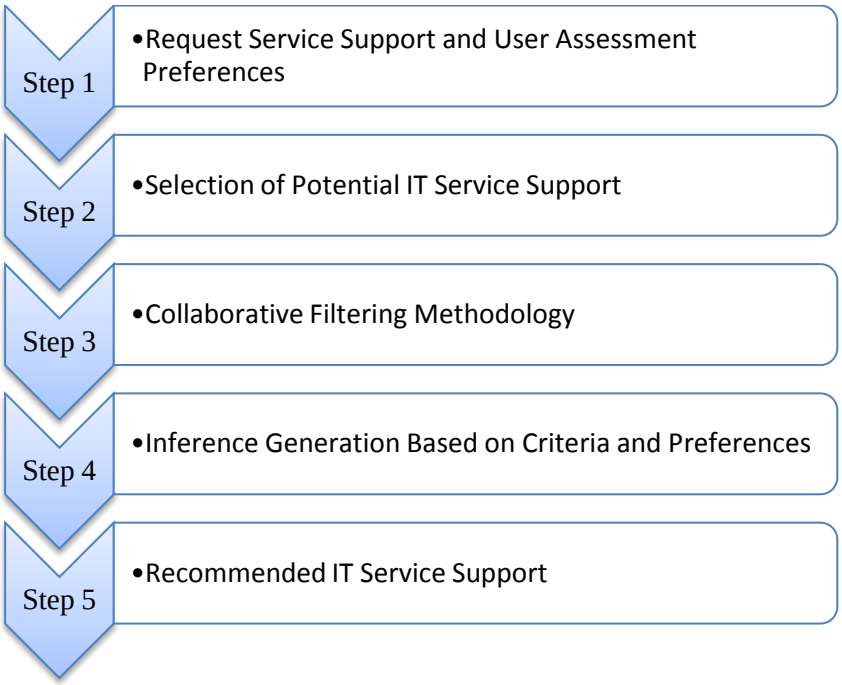

Figure 3. Inference process for recommendation

Tool Testing & Evaluation

The suggested criteria for the system development approach described by Burstein and Gregor (1999) will be used for evaluation of the system development work. A prototype of the proposed system will be constructed for this purpose in the next stage of the project.

Challenges to date

Although the results of all KPIs examined in this case study have demonstrated some improvement, it did not fully meet our initial expectations, as some of the processes did not have significant improvement. There are two major possible explanations for this outcome pattern. Firstly, the duration of the testing phase is not long enough for the test group to experience ample improvement. For example, there were no major software maintenance upgrades performed during the test period. Secondly, some of the intended process reengineering efforts could not be fully implemented during the period of this case study, as it required more time, effort, and budget. For example, Problem Management required a focus group and a pool of technical expertise that was not available during the pilot project. However, a case study such as this serves as a trigger for major reengineering of business processes. It could motivate the senior management to allocate appropriate budget, and plan a gradual implementation of process reengineering. The ITIL framework consists of a well evaluated set of best practice guidelines. It certainly serves as a tool for exploring process reengineering and improvements while meeting the budget constraints. The case study required substantial coordination and consensus while identifying process improvements, establishing a process reengineering methodology, and constructing questionnaires for process evaluation.

Case B – Software Mediated Process Assessment (SMPA) Tool

Continual Service Improvement

IT services are not only essential to the internal efficiency of the organisation, many are deemed to be mission critical. Consequently, organisations need to continually assess and improve the ITSM processes that underlie the IT services to ensure their stability, reliability and effectiveness. The assessment effort, however, is manually time-consuming and also costly, especially if external consultants are involved. More importantly, assessments need to be undertaken objectively and methodically so that the organisation can repeatedly measure process improvements and confidently make changes to those ITSM processes requiring improvement.

The Software Mediated Process Assessment (SMPA) tool development project was funded by the Australian Research Council (ARC) and an industry partner. The project has two aims:

a) to develop a prototype software tool based on international standards to facilitate continual service improvement in ITSM, and

b) to evaluate the effectiveness of the tool by implementing it in two large Australian public sector organisations and validating results against traditional assessment methods.

In the current ITIL version (2011 edition) the framework departs from its prior ‘process silos’ approach to take a lifecycle view of ITSM. Under this lifecycle view, ITSM processes are designed, created, transitioned into live environment and then operationally supported. This is reflected in the names of the four key books that describe the processes and functions structured over the stages of the service life cycle: Service Strategy, Service Design, Service Transition and Service Operation. The fifth book on *Continual Service Improvement* (CSI) emphasizes the need for an ongoing effort to identify opportunities for improvement of weaknesses or failures within the lifecycle stages. The book further stresses that the “real

work" begins after the development and roll-out of the new processes (OGC 2011). This CSI requirement, which is consistent with the continual improvement principle in the ISO 9000 standards for quality management systems, is also ingrained in ISO/IEC 20000 to the extent that one of the clauses in the standard mandates that "there shall be a policy on continual improvement of the service management systems" (ISO/IEC 2011).

The purpose of CSI is to continually align and re-align IT services to the changing external business conditions by identifying and making appropriate improvements to the ITSM processes (OGC 2011). The need to make these improvements is further heightened by the fact that over time the quality of IT services tends to deteriorate as the ITSM processes are subjected to unauthorised and unwarranted modifications. CSI is important to the business as it deals with the continuing relevance and responsiveness of the IT services to customers, while addressing the effectiveness and efficiency of the underlying ITSM processes. It has been shown that 60 - 90 percent of the total cost of IT ownership is concerned with the delivery and support of IT services (Macredie & Mijinyawa 2011). This cost can be reduced through CSI, especially if it is facilitated by the use of innovative tools and methods.

CSI activities, however, are expensive as they are resource-consuming (OGC 2011). Moreover, process improvement programs in general may be difficult to sustain and may even regress over time if they are not effectively managed (Harkness, Kettinger & Segars 1996; Keating et al. 1999). To undertake CSI activities many organisations perform process assessments. These assessments involve the systematic measurement, analysis and reporting of the performance of core ITSM processes. The results are then used to evaluate the capabilities of these processes and drive process improvement activities. The gathered data could be used to develop a business case to justify the CSI effort. At the same time, the data would serve to verify the overall benefits from the ITIL or ISO/IEC 20000 investment. Process assessment, however, needs to be differentiated from audit: the former is undertaken to advise corporate management on how they can improve their operations while the latter is initiated to uncover suspected problems (Galup et al. 2009). This fundamental difference is reflected in the role and attitude of the assessors during the process assessment.

Traditionally organisations would engage consulting firms to perform the process assessment and make recommendations on the ITSM areas requiring improvement. Repeatedly engaging qualified and experienced ITSM consultants to perform process assessment is expensive and lacks objectivity and consistency (Fayad & Laitinen 1997).

In addition, their outcomes are often dictated by the proprietary methodology and toolset employed by the consulting firm. An alternative to relying on consultants is for organisations to carry out the process assessment themselves using specialised software tools that may be integrated within a knowledge-based repository of ITSM best practices. This approach, known as *software-mediated process assessment* (SMPA), involves the appointment of an internal team of assessors to undertake the assessment on a regular and systematic basis, aided by software tools and with minimal or no outside assistance. The tools facilitate planning, collecting, validating and classifying the improvement evidence for subsequent analysis. To automate the assessment further, advanced features can be built into the software tools to perform the analysis and suggest recommendations.

To ensure objectivity and consistency to the SMPA, the model that underpins the design of the supporting software tools is the international ISO/IEC 15504 standard for process assessment (ISO/IEC 2005). The multi-part standard originated from the software engineering discipline but in recent years has been broadened to address non-software domains, such as banking, automotive and aerospace, in large as well as small enterprises (Di Renzo et al. 2005; Rout 2003; van Loon 2007). In fact, ISO/IEC 15504 has been shown to be

particularly valuable in facilitating the improvement of non-software processes as these processes tend to be more "repetitive and stable" than those pertaining to software production (Coletta 2007). An assessment, as described in ISO/IEC 15504, compares the actual performance of a process in an organisation against a model of process capability termed a *Process Assessment Model* (PAM). A PAM has two dimensions: process performance, and process capability. The capability dimension is derived from a measurement framework that serves to characterize the capability of key processes in the chosen domain (ISO/IEC 2004). A PAM provides a detailed model based on one or more Process Reference Models (PRMs) for the purpose of assessing process capability. Part 8 of the ISO/IEC 15504 standard provides an exemplar PAM for ITSM. Various research initiatives are currently underway to link ISO/IEC 15504 to the ITSM domain through the development of appropriate process models based on ITIL and ISO/IEC 20000 for example Barafort et al. (2008) and Nehfort (2007). An ISO/IEC 15504-compliant methodology, Tudor's ITSM Process Assessment (TIPA), has been developed by the Public Research Centre Henri Tudor (Hilbert & Renault 2007). ISO/IEC 20000 requirements can be translated into a PRM for ISO/IEC 15504 compliant assessment (Barafort et al. 2008) and a PRM is available in the ISO/IEC 20000 standard (ISO/IEC 2010). Such a PRM is a requirement for a conformant assessment using a PAM based on ISO/IEC 15504 (Mesquida et al. 2012).

SMPA, although not new in software engineering where the notion of process assessment is heavily emphasized, is an innovation that has not been previously studied in ITSM. Existing software tools are available to expedite the various tasks of managing IT services: however, little is available to assist continuous service improvement. Indeed ITIL specifies that "technology will need to be in place for monitoring and reporting" so that CSI can occur (OGC 2011). The first research question (RQ1) for this project therefore explores: *to what extent is SMPA a valid and beneficial approach in facilitating CSI activities in ITSM?* Past research has shown that innovative IT initiatives that alter existing practices in organisations, such as the introduction of new management frameworks (e.g. ITIL) and methods and tools (e.g. object-oriented methods and CASE tools) are inherently problematic in implementation and may not yield the expected results. In such initiatives, organisations are presented with a range of challenges that are not only related to the technology or methodology in question but are organisational and managerial in nature (Lai & Mahapatra 1997). Similar concerns are apparent for SMPA. The second research question (RQ2) asks: *what factors impact on SMPA implementation?*

One of the strengths of the ISO/IEC 15504 standard is that it provides a structured approach for an organisation to understand the current state of its own processes and to undertake steps to improve the capability of these processes. The standard is grounded on the principles of self-assessment, process improvement and capability determination, and is applicable to all types and sizes of organisations (ISO/IEC 2005). ISO/IEC 15504 is also tool-agnostic i.e. its requirements are independent of the use of any tool. Barafort and colleagues at the Henri Tudor Institute (Barafort, Di Renzo & Merlan 2002; Barafort, Humbert & Poggi 2006; Barafort et al. 2008) used ISO/IEC 15504 to enable assessors to produce repeatable and objective ITSM process appraisals but this work was undertaken without the support of a SMPA tool. Their research indicates that ISO/IEC 20000 requirements can be translated into the PRM required to drive process assessment in ITSM. The third research question (RQ3) seeks to answer: *To what extent does the PAM in ISO/IEC 15504-8 and the PRM in ISO/IEC 20000-4 jointly provide a coherent and consistent basis for the development of a SMPA tool for CSI in ITSM*?

The final research question (RQ4) follows on from RQ3: *does the use of a SMPA tool lead to effective CSI decisions?* The outcomes from SMPA activities are to a large extent dependent

on the methodology that is embedded in the supporting tool. If the SMPA tool is designed around a proprietary methodology it tends to behave as a black box as the logic and rationale behind the analysis and recommendations may not be disclosed to the assessors. In this case the assessors are not able to ascertain the validity of the recommendations to the specific business environment nor can they compare their assessments with that of their peer organisations which may have used a tool from another vendor. Hence, the apparent advantage offered by the ISO/IEC 15504 standard is that it provides desired transparency and objectivity in the appraisal. The scope of the SMPA project is illustrated in Figure 4.

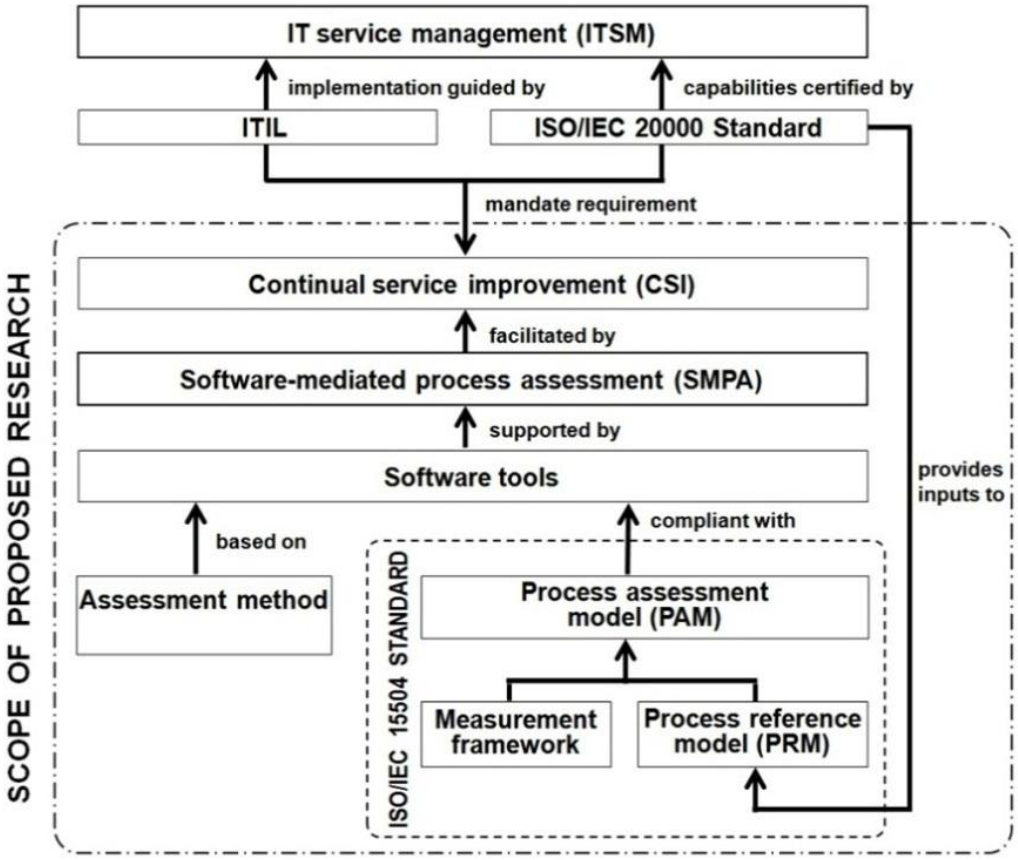

Figure 4. **Scope of Research** (Source Cater-Steel et al. 2013)

SMPA approach and methodology

The SMPA research team comprises academics from two universities, who have expertise in ITIL, ISO/IEC 20000 and ISO/IEC 15504. A doctoral student was recruited to the team.

The team worked closely with experienced ITSM practitioners at the partner organisations: Assessment Portal, the Queensland Government ICT division (CITEC) and the Toowoomba Regional Council (TRC). Assessment Portal provided the platform for the development of the prototype SMPA tool. It is an Australian company that specialises in delivering commoditised consultancy through its automated assessment portal.

The Design Science Research (DSR) methodology was used in the project to address the four research questions. DSR has been referred to as "improvement research" as it aims to produce and apply knowledge of tasks or situations in order to create effective artifacts to improve practice (Vaishnavi & Kuechler 2008). The creation of such research artifacts and their evaluation is central to DSR. This research draws on the DSR framework and methodological guidelines for information systems research suggested by Hevner et al. (2004). Their DSR

framework, which combines both behavioural and design science paradigms, comprises three interlinked research cycles: relevance, rigour and the central design cycle (Hevner 2007), as illustrated in Figure 5.

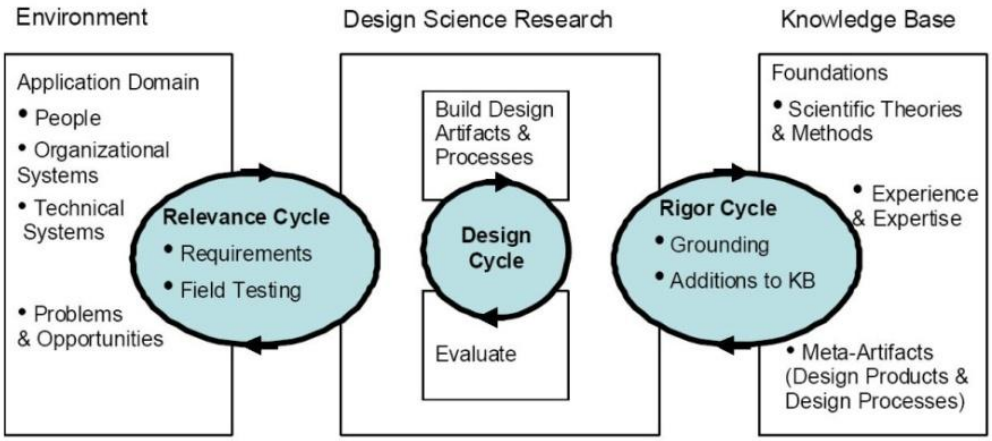

Figure 5. Design Science Research Cycle (Hevner 2007)

The *relevance cycle* inputs requirements (continuous service improvement) from the service management and process assessment standards and the three partner organisations into the research and introduces the research artifacts (prototype SMPA tool and changed CSI processes) into the field testing. The *design cycle* supports the loop of research activity that provides the construction, refinement and evaluation of the research artifacts. The *rigour cycle* develops the methods (benchmarking and assessment methods) along with domain experience and expertise from the "knowledge base" (ITSM practitioners' experience, ISO/IEC 20000 and ISO/IEC 15504) for the research. During the study, recent DSR insights from the work of Vaishnavi & Kuechler (2008), Peffers et al. (2008), Gregor & Jones (2007) and others were referenced for additional guidance.

SMPA tool design and development

Task Technology Fit (TTF) theory (Zigurs & Buckland 1998) has been associated with evaluative research where a fit of task requirements is sought from existing technologies (Fuller & Dennis 2009). In the SMPA project TTF theory is applied to understand the development of a new technology for particular task challenges. This approach is particularly suitable for Design Science Research (DSR) to exert rigour in explaining development of novel artefacts. This also makes sense in the practical world: requirements must be carefully considered before designing and developing a technology solution to overcome task challenges. The design and development of the tool was conducted over three stages. In the first stage, requirements for assessment workflow and automation to be supported by the tool were distilled (technology requirements) based on task challenges. A fit profile was then established to provide a set of design principles to guide the development of the tool as the second stage. This was followed by the third stage of tool development based on the design principles of the fit profile.

SMPA tool testing and evaluation

DSR projects require an evaluation phase in order to determine effectiveness of the artefact (Hevner et al. 2004). Therefore, the utility of the tool was examined at both pilot organisations. Two large public sector organisations agreed to pilot test the SMPA tool:

CITEC and Toowoomba Regional Council (TRC). Both CITEC and TRC are well recognised by the ITSM industry for their ITIL expertise and were recruited to participate in the pilot testing of the prototype tool.

TRC is one of the largest local government authorities in the state of Queensland in Australia servicing a regional population over 160,000 with approximately 1,700 council employees. TRC's IT service department employs 55 IT service staff and delivers IT services to residents across a large area in Australia servicing over 150,000 residents. The IT service department provides 34 identified services supporting IT functions in the organisation and typically manages 300 service requests per week. Three ITSM processes were selected for assessment at TRC: Problem Management, Change Management and Configuration Management based on a process selection approach that provides decision support in selecting critical processes to improve (Shrestha et al. 2013).

CITEC is the primary technology service provider for the Queensland Government in Australia delivering both whole-of-government and agency-specific ICT services. The Queensland Government Chief Technology Office (QGCTO) is also established within CITEC. The three processes assessed at CITEC were problem management, service level management and configuration management.

At each organisation, one nominated assessment facilitator was trained to use the tool console. Likewise, 10-12 process stakeholders at each organisation participated in the assessment survey. For each organisation, the SMPA tool collected survey responses and generated a report with process capability score ratings, process improvement recommendations, and comments from the respondents. There were a total of 93 and 319 process improvement recommendations presented in the assessment reports at the two organisations. In order to compare the process and outcome of the SMPA approach with a conventional process assessment, a manual process assessment based on the RAPID method (Cater-Steel, Toleman & Rout 2006) was also conducted at each organisation.

The evaluation revealed that SMPA participants found the tool easy to use and largely agreed that a self-assessment experience made the exercise more useful and less costly. The managers confirmed accuracy of the output of the tool in terms of assessment ratings and the improvement recommendations. Feedback to improve the wording of assessment questions was incorporated to further improve the assessment questions. The summative evaluations on tool usability and outcomes will enable further enhancements to the assessment questions, score determination and reports generated from the tool. In future, following repeated use of the tool, it will also be possible to conduct a long-term outcome evaluation by observing the impact of the SMPA approach on continual service improvement (Shrestha et al. 2014).

Challenges encountered

The start of the SMPA project was delayed for several reasons. A government organisation that had initially committed to pilot test the tool withdrew due to a change in focus. Fortunately, TRC was recruited in its place. The Multi-Institutional legal agreement between two universities and three partner organisations was complex and took some time to formalize. The intellectual property arrangements pertaining to the SMPA needed to be carefully considered due to the potential commercial value of the SMPA tool. Although a scholarship was offered by the ARC and supplemented by the funding partner, it took about 12 months to recruit a suitable doctoral student to the project.

A detailed project plan was developed in close consultation with the partner organisations and the project governance structure was activated. On the request of the funding partner, the scope of the project was extended to include the development and operationalization of a

model for a decision support tool to select ITSM processes for assessment (Shrestha et al. 2012). During the first stage of the project, two academic members of the team retired from full-time work but continued to make worthwhile contributions to achieve the project outcomes. An ongoing concern involved the participation of CITEC as a pilot site. In 2012 the newly-elected Queensland State government announced its plans to divest the organisations. Despite radical staff changes at CITEC, the SMPA trial and evaluation were performed and a manual assessment conducted. The SMPA research project is currently in its final stage with the doctoral student preparing the thesis for examination. The industry partner has incorporated the developed model into the range of assessment services offered to their clients.

Discussion

Although both projects addressed problems in the domain of IT service management, the scope of the processes varied significantly. The DSRS project developed and used the architecture of the proposed decision support recommendation system that has an interface with query processing capabilities and a dashboard; the inference engine for logic/algorithm computations; and the databases composed of the knowledge and operational data. The next stage of the project requires the development of a prototype to implement the design and further engagement with the industry partner for the evaluation of the DSRS in terms of validity and utility. In contrast, the SMPA project included the design, development, implementation and evaluation of a prototype decision support system to enable assessment of IT service management processes. Further effort is underway by the industry partner to extend the prototype from four processes to the full range of service management system processes as defined in the international standard for ITSM (ISO/IEC 20000).

The underlying theories and methods also varied between the two projects. The DSRS project used an inference-based DSS architecture that provides a powerful querying interface with a dashboard to its users in order to extract recommendation items for decision support from the operational databases. The “System Development” approach from Burstein and Gregor was followed in the project. SMPA used TTF as the kernel theory and followed the DSR method to design, develop, test and evaluate the tool. Regardless of different problem domains and research methods, three distinct similarities exist, namely:

1. The parent discipline of IT Service Management and process-oriented solution architecture;

2. Knowledge base of ITIL based recommendations in the solution architecture;

3. Engaged management scholarship demonstrated by the project management of multi-disciplinary team involving academics and industry practitioners to develop academically rigorous and industry relevant solutions.

Conclusion

Research and practical contributions have been claimed from both projects. The DSRS contribution was a system that can alleviate the possibility of expensive mistakes if a major process reengineering is initiated at once. Actually, the customer company appreciated the efforts in this case study which were well received, and motivated for further reengineering of company-wide processes. The study proposed a comprehensive DSS client/server system which further improves the IT service support process in reading real time KPIs and IT service actions. Further work on this research can focus on automatic implementation of IT service support actions based on DSS signals.

The SMPA project has made a unique contribution in the integration of the design science research methodology with the task-technology fit theory for the development of the software

tool as a research artefact. For practitioners the project demonstrated transparent and efficient self-assessment of IT service processes that facilitates continual service improvement (Shrestha et al. 2014).

The two projects described show that academic researchers can make valuable contributions to the design and investigation of innovative software tools. However, effective transition of these tools to industrial use requires their integration into, and evaluation within, the industrial and business context. In some cases the innovation required is not so much the design of a new tool but its adaptation to the pattern of use within the organisation.

We recognise the limitations of our approach: we mainly relied on published reports from the project and our personal recollections. A more objective report may have been compiled if other team members and partner organisations were canvassed for their perceptions on how the projects were managed and the quality of the outcomes.

Software tools play a vital role in helping organisations achieve productivity and in assuring the quality and integrity of their products and processes. Productivity is enhanced by tools that automate processes or minimise the cognitive and physical effort required of those undertaking a task. Integrity is enhanced by tools that apply procedures without fear or favour, for example in the assessment of ITSM processes as shown in the SMPA case.

These two projects provided valuable research training in the form of knowledge and inquiry skills for the participating students. These two projects are examples of engaged management scholarship where the research team includes academic staff, students and industry partners who work together to solve problems of IT Service Management using mixed and multiple forms of inquiry and theory.

The models and systems developed form a base for subsequent research, implementation and evaluation that will contribute to such efforts as the International Standards for ITSM and process assessment and inference-based DSS architecture.

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Note: ITIL® is the registered trademarks of the UK, Office of Government Commerce.

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