SOFTWARE-MEDIATED PROCESS ASSESSMENT FOR IT SERVICE CAPABILITY MANAGEMENT

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Research in Progress

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Abstract

Process improvements provide a structured approach for an organisation to improve the way they operate. A number of process improvement methodologies such as ISO9000, TQM, Six Sigma, Lean, and Agile have been proposed over the last few decades and subsequently software tools have been developed to apply these methodologies. However, the determination of process capabilities to measure improvements is predominantly conducted by expert process assessors and consultants with their proprietary frameworks. We propose the use of the international standard of process assessment ISO/IEC 15504 for a consistent measurement of process capability. We also demonstrate development of a software tool based on the standard. This tool enables organisations to self-assess their processes efficiently. In this paper, we explain the development and implementation of a software-mediated process assessment approach in the area of IT Service Management at two large public-sector IT organisations in Queensland, Australia. This paper’s unique contribution is 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 demonstrates transparent and efficient self assessment of IT service processes that facilitates continual service improvement.

Keywords: Process Assessment, IT Service Management, Task-Technology Fit, Design Science Research, ISO/IEC 15504.
1 Introduction

Organisations have adopted methodologies such as ISO9000, TQM and Six Sigma for better business performance in terms of process effectiveness and efficiency (Harrington, 1991). Software developed to apply these methodologies such as Business Process Modelling tools have expedited process adoption and improvement (Aguilar-Saven, 2004). However, process assessments lack uniformity and transparency in the way they are conducted (Lloyd, 2011). Moreover it is reported that process assessments are costly and time-consuming (Fayad and Laitinen, 1997; Lloyd, 2011).

ISO/IEC 15504, the international standard for process assessment has emerged as a general process assessment standard. In response to the paradigm shift of IT’s focus from technology to service provision, the standard has published a process assessment model for IT services (ISO/IEC, 2012). We intend to evaluate the standard assessment model by developing a software tool based on the model to enable organisations to self-assess service processes. Investment in IT services exceeded that in IT devices, IT systems and enterprise software in 2012 and is forecast to continue (Lovelock, 2013). It is obvious that businesses will increasingly evaluate IT in terms of what value is offered by IT services rather than how the technologies are managed. The IT Service Management (ITSM) discipline has embraced a process approach to manage IT. The popular ITSM framework, Information Technology Infrastructure Library (ITIL®) and the international standard for ITSM (ISO/IEC 20000) stress the importance of process improvement for better IT service quality to support business activities. In practice, ITSM is endorsed by an internationally active practitioners’ forum but there is limited scholarly work in this discipline (Winniford et al., 2009).

The research problem that motivates this research is the lack of transparency for effective process assessments and the need for efficiency for organisations to repeatedly conduct process assessments. We propose an approach called Software-mediated Process Assessment (SMPA): a standard-based approach by which organisations can self-assess their processes using a software tool to determine process capabilities. A research project in collaboration with academics, practitioners and standards committee members with combined expertise in ITSM and process assessment was initiated in 2011 to develop and evaluate performance of the SMPA approach. The research team includes an industry partner, Assessment Portal, which provided its software platform to develop our tool, and the IT service departments of two large public-sector organisations in Queensland, Australia to evaluate the tool. The overall research question of our project is: How well can an organisation manage its service capability using the software-mediated process assessment approach? The objective of this paper is to report the development of the software tool developed for the SMPA approach. Since the evaluation part of the research is in progress, the sub-question that this paper focuses to answer is: How can a software tool based on a standard assessment model be developed for a transparent and efficient process assessment? We approach this research as a Design Science Research (DSR) project (Hevner et al., 2004) with the focus on building the software tool as an IT artefact.

This paper is structured based on the DSR publication schema suggested by Gregor and Hevner (2013). The introduction section discussed the research problem and research question. The next section provides an overview of existing ITSM process assessment frameworks, followed by the research methodology. The artefact development and demonstration are then explained. A note about evaluation is provided before a conclusion including limitations, contributions and future work.

2 Literature Review

In DSR projects, it is advised to use established kernel theories to inform and justify the research (Venable, 2006). We present the task-technology fit (TTF) theory (Zigurs and Buckland, 1998) as the kernel theory to advise how the task challenges in process assessment and technology requirements for
a new software tool fit together to articulate the artefact design and development. The choice of TTF theory is justified by the core focus of the research question to build a technology solution in response to task challenges. An ideal fit profile is generated to match the task challenges in process assessments and technology requirements for the software tool.

TTF theory proposes that IT is more likely to have a positive impact on individual performance if the capabilities of the IT match the tasks that the user must perform (Goodhue and Thompson, 1995). TTF deviates from self-reported user evaluations and looks at the “fit” between the technology features and the task requirements to be supported by the technology. Zigurs and Buckland (1998) applied TTF theory for evaluation of group performance by verifying the fit with group support systems technology. Since then the theory has been applied to a diverse range of information systems and is considered one of the prominent theories to explain the impact of IT on performance. We adopt Zigurs and Buckland’s TTF theory for two reasons: the SMPA tool is a decision support tool that shares similar technology dimensions as proposed in the theory, viz. communication support, process structuring and information processing; and our approach of designing an ideal fit profile to match task and technology is supported by this theory.

2.1 Existing Frameworks of ITSM Process Assessment

There are several commercial ITSM process assessment tools (e.g. PinkElephant, 2013). These services can be considered as a black box since the rationale behind the assessment activities is not disclosed. We found three frameworks from the literature review: (a) Tudor’s ITSM Process Assessment provides an overall approach to conducting process assessments based on ITIL and ISO/IEC 15504 (Barafort et al., 2009); (b) Standard CMMI Appraisal Method for Process Improvement (SCAMPI) uses CMMI for Services (CMMI-SVC) as the measurement model (CMMI, 2010); and (c) ITIL Process Maturity Framework assesses ITIL processes (MacDonald, 2010). The role of ISO/IEC 15504 as a consistent measurement framework for ITSM process assessment was confirmed by Mesquida et al. (2012). We did not find published research or industry initiatives on transparent approaches to conduct self-assessments. We base our research on this identified gap.

3 Research Methodology

We use DSR (Peffers et al., 2008) as our methodology because this research is motivated to develop a novel artefact in order to solve an organisational problem (Hevner et al., 2004). Figure 1 shows the integration of the TTF theory process model with the DSR methodology.

We deal with a decision task of determining process capability and improvement recommendations in process assessments. Addressing transparency and efficiency are two major challenges of process assessments. The task challenges represent the first DSR phase of problem identification and motivation. The second DSR phase, objectives of a solution can be defined from the three technology dimensions derived from the TTF theory (Zigurs and Buckland, 1998): communication support, process structuring and information processing. We use the technology dimensions as technology requirements for the development of the tool. Ultimately alignment between task challenges and technology requirements is represented with an ideal fit profile that proposes design principles for the tool development. The fit profile and the tool are developed during the design and development phase.

As illustrated in Figure 1, the concept of fit articulated by the TTF theory in terms of matching task challenges and technology dimensions aligns with the primary objective of DSR to develop a research artefact as a solution to identified problems. Therefore, the research artefact can be described using a fit profile (instantiated as the SMPA tool) where challenges of process assessment (task) are addressed using the technology dimensions from the TTF theory.
Two case study organisations are selected to execute the demonstration and evaluation phases of DSR. Evaluation is planned during three stages of the research: development method evaluation, tool experience evaluation and SMPA approach evaluation. Evaluation is conducted using semi-structured interviews with IT service managers and process performers. This paper is a research publication of the communication phase of DSR to obtain feedback regarding the development of the artefact.

4 Artefact Design and Development

TTF theory has been associated with evaluative research where a fit of task requirements is sought from existing technologies (Fuller and Dennis, 2009). We extend the application of TTF theory to design a fit profile to understand the development of a new technology for particular task challenges. This approach is particularly suitable for DSR to exert rigour in explaining development of novel artefacts. It also makes sense in the practical world: requirements must be carefully considered before designing and developing a technology solution. Therefore, integration of TTF theory in the DSR process is an original research approach illustrated in Figure 1 and we propose this integration as a unique contribution of this paper.

We now discuss four stages of tool design and development: (1) the challenges for a transparent and efficient process assessment (task challenges); (2) requirements for assessment workflow and automation to be supported by the tool (technology requirements); (3) design of a fit profile based on for developing the tool; (4) application of design considerations from the fit profile to develop the tool.

4.1 Defining Task Challenges

We define two task challenges in process assessments: transparency and efficiency.

a) Transparency: For our task of process assessment, transparency is the concept of facilitating assessment activities with accessible information. Existing ITSM process assessment frameworks use proprietary assessment models and follow indistinct assessment activities. The issue of transparency is therefore a significant hurdle in conducting an objective process assessment. The standard mandates the requirement of a documented assessment process to determine assessment workflow. We therefore consider transparency as a task challenge that needs to be addressed by the technology solution.

b) Efficiency: Efficiency determines the degree of economy with which any assessment consumes resources, especially time and money (Roberts, 1994). We believe efficiency can be achieved in process assessments since a number of process assessment activities can be automated with the use of the tool. This translates to significant cost savings from not using expensive assessors and consultants while enabling repeated self-assessments for organisations. We consider efficiency as our second task challenge.
4.2 Defining Technology Requirements

According to the TTF theory, technology requirements for the challenges of a decision task must focus on “information processing” and “process structuring” dimensions of technology for enhanced performance (Zigurs & Buckland, 1998). We use the term "technology requirements" rather than "technology dimensions" as used originally in the theory. This is because we are not evaluating existing technology dimensions for a fit but developing a technology solution that fits task challenges to technology requirements.

- **Process Structuring**: The tool must define the assessment workflow steps to conduct the phases of the assessment: Definition, Preparation, Assessment, Analysis, Results Presentation and Closure phases (Barafort et al., 2009). The technology requirements of process structuring should lead to the development of the tool that can facilitate the entire assessment approach in a transparent manner.

- **Information Processing**: The ability to automate some activities of process assessment is considered as the information processing requirement: assessment data collection and validation, process capability ratings and reporting of the assessment results requires gathering, aggregating, evaluating and finally presenting information. Therefore, having an efficient information processing capability is an important requirement for the tool.

4.3 Designing the fit profile

Venkatraman (1989) discussed the perspective of fit as “profile deviation” to observe the degree of association between a fit profile and its effect on performance. Since we approach the TTF theory to develop a new technology for task challenges, our proposed fit profile is not designed to evaluate performance. Instead, the fit profile provides considerations for the tool development based on the task challenges and technology requirements. We group our task challenges as a typical “decision task” since process assessments are conducted to make informed decisions on improving processes continually.

The fit profile as shown in Table 1 answers the research question: how can a software tool based on a standard assessment model be developed for a transparent and efficient process assessment? It provided design principles to guide the design process for the development of the SMPA tool.

<table>
<thead>
<tr>
<th>Task Challenges in Process Assessments</th>
<th>Technology Requirements for SMPA tool</th>
<th>Artefact Development Considerations</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>Information Processing</td>
<td>Automate Assessment Activities</td>
<td>Software tool</td>
</tr>
</tbody>
</table>

*Table 1. Fit profile for tool design and development*

4.4 Development of the SMPA tool

We used the fit profile to arrive at the two development considerations and the two key resources we needed before commencing the actual tool development. Based on the development considerations and using the resources from the fit profile (see Table 1), our research artefact was developed to address the task challenges using technology requirements.

While most of the existing process assessments rely on process-specific indicators that demonstrate objective evidence of process capabilities, the software tool facilitates a top-down approach where assessment at each level is defined with a goal and then assessment is guided by explicit questions and
metrics that are set to goal attainment. A top-down approach in process assessment ensures that the measurement follows a transparent workflow of assessment activities. This approach is guided by the Goal-Question-Metric (GQM) approach. The GQM approach defines a measurement model for software metrics on three levels: goal (conceptual level), question (operational level) and metric (quantitative level) (Van Solingen et al., 2002).

While the GQM approach has been previously applied in the software industry, use of this approach to develop a process assessment tool in ITSM is novel. The international standard defines a reference model where each process is defined in terms of purpose and outcomes (ISO/IEC, 2010). Attainment of the process purpose by meeting the outcomes defines the “goal” component of the software tool.

Likewise, the standard provides a set of base practices to fulfil the process outcomes and a set of generic practices for Level 2 (process management), Level 3 (standardisation), Level 4 (quantitative measurement) and Level 5 (innovation) of process capability. In a formal process assessment, these would be used as indicators to enable evaluation of the process capabilities. In our context, the emphasis is on less formal assessment to provide information that can drive improvement of IT service processes. These indicators have been translated into a set of assessment questions. The tool allocates these questions to the respondents based on three process roles: process performers, process managers and other process stakeholders. This defines the “question” component of the tool.

Finally every question is rated using the scale: “Not”, “Partially”, “Largely”, “Fully” and “Not Applicable” as defined in the standard. Rather than the assessment team making a subjective choice of the indicator rating, the software tool has a “metric” component that collects and objectively measures feedback from the process stakeholders directly from the responses to the questions.

The application of an objective GQM approach for assessment workflow is the key facilitator for a transparent process assessment. The features of the SMPA tool that facilitate assessment workflow and automate many of the assessment activities are illustrated in Figure 2. A screenshot of the survey interface of the tool is available on the project website (INVEST, 2014).

![Figure 2. Structure of the Software-mediated Process Assessment tool](image)

**a) Assessment Data Collection & Validation:** The tool collects responses from all the concerned process stakeholders. The approach of asking questions directly in a web-based survey environment represents a faster and more efficient data collection method compared to assessment interviews (Deutskens et al., 2006).

**b) Process Capability Determination & Rating:** We use the standard guidelines for each process to calibrate the process capability ratings. The software tool determines the final score for each capability level by calculating the mean value of all the responses for that level by all the respondents. The coefficient of variation (CoV) score is computed and can be used to determine reliability of the process score based on dispersion of the responses. The mean value and the CoV are simple yet effective statistical measures to understand what the critical mass of assessment respondents believe about the processes being assessed.
With the software tool facilitating online surveys, process assessments can reach all process stakeholders regardless of proximity. This approach may not fully correspond to a formal process assessment which is generally conducted by taking multiple factors into consideration: manifold objective evidence, observations, document reviews and expert judgment. However automating parts of the assessment activity can drive self-assessments by providing a Do-It-Yourself option to IT organisations. Automation of these assessment activities enabled by information processing is a major driver in support of efficiency.

c) Assessment Reporting with Process Improvement Recommendations: The SMPA tool is not only a stand-alone survey engine; it has embedded a knowledge base that stores recommendations for process improvements. Using the knowledge base developed from best practice guidelines for process improvements, the tool performs gap analysis based on the collected response metrics and produces a report with improvement recommendations. We developed the knowledge base with recommendation items at the question level for four IT service processes. For every question when the mean rating is either "partially" or "not", i.e. there is an element of risk in the process activity, a recommendation item is extracted from the knowledge base and the items are compiled into an assessment report.

5 Artefact Demonstration

We implemented the tool in two case study organisations. At each organisation, three ITSM processes were selected for assessment using a process selection method (Shrestha et al., 2013), and one assessment facilitator 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, we also conducted a manual process assessment (Cater-Steel et al., 2006) at each organisation.

6 Artefact Evaluation

This paper reports primarily on the design and development of the artefact. However, DSR projects require an equally important evaluation segment in order to determine effectiveness of the artefact (Hevner et al., 2004). From the TTF theoretical perspective as well, the current work is focused on the generation of the fit profile and the software tool. However evaluation of the fit needs to be reviewed by examining the utility of the tool and we plan to evaluate the perceived decision quality and perceived decision efficiency (Jarupathirun and Zahedi, 2007) experienced from the SMPA approach at the two case organisations selected for this project. This part of the research project is in progress.

Our evaluation is based on the framework of Pries-Heje et al. (2008). The ex-ante evaluation took place in several iterations during the design and development of the artefact by the research team which included ITSM practitioners and researchers. As part of an iterative build-evaluate cycle (Hevner, 2007), several evaluation checkpoints were implemented during artefact design and development. For instance, the use of the TTF theory for a fit profile to obtain development considerations for the tool, adherence to the international standard of process assessment, use of the GQM approach in facilitating assessment workflow, and software automation in several assessment activities. Moreover, assessment questions were pilot tested and feedback incorporated to further improve the clarity of the questions during artefact development.

In the ex-post evaluation stage we interviewed survey participants regarding their use of the tool in focus group discussions at the two case study organisations based on the usability concept from the

Preliminary findings reveal that participants found the tool easy to use and largely agreed that a self-assessment experience made the exercise more useful and less costly: “I can be honest as I am not being watched [during assessment survey]” and “…the survey can be very accurate, and is probably a better return on investment because you are not taking up everyone’s time all at once...”. There was feedback to improve the wording of assessment questions: “I think the questions were relevant but the interpretation was the big barrier … once you understand what was being asked and how it was presented, it became a lot easier to answer the questions”. This feedback is incorporated to further improve the assessment questions. The next round of interviews will evaluate how well an organisation can manage their service capability. 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 service capability management.

7 Conclusion

The SMPA approach is expected to address transparency issues in process assessment by following a goal-oriented measurement of IT service processes using a standard process assessment model. Besides the use of the international standard for process assessment, the contributions of the SMPA approach on its own are twofold: (a) transparency and efficiency by using online surveys to allow faster and consistent assessment data collection and analysis; and (b) use of a knowledge base of best practice guidelines for improvement recommendations.

The iterative design process can be reused for the development and evaluation of similar assessment approaches beyond the discipline of ITSM, such as IT governance (COBIT). The SMPA approach can be applied to other domains of IT services such as customer satisfaction, service value and service behaviour (Lepmets et al., 2012) by selecting appropriate frameworks for the survey engine and knowledge base of the SMPA tool.

Our unique contribution to knowledge is the application of the fit profile from task and technology requirements to develop an artefact as a technology solution for task challenges. More specifically, the integration of TTF theory with the DSR methodology is a novel approach. Our research framework demonstrates to future researchers the value and applicability of a kernel theory (TTF theory in this research) to justify their design process (DSR methodology). Our research framework is also expected to be beneficial when an explicit specification of task problems and technology solution options has guided the design process in DSR projects, such as the case in this research. Moreover the implication of this research in practice is the goal-oriented measurement based on the GQM approach for process assessments in IT service management.

We recognise limitations of this research: only three IT service management processes were assessed at two sites. Consequently, we do not claim generalisation and call for future research to investigate and evaluate the SMPA approach in more organisations and in broader disciplines beyond ITSM. Moreover, in practical terms, we do not claim that the SMPA approach can replace a formal and rigorous process assessment. The tool is developed with an intention to automate several activities of a standard process assessment and therefore enable organisations to repeatedly self-assess their processes for improvements.
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