UNIVERSITY OF SOUTHERN QUEENSLAND

DEVELOPMENT AND EVALUATION OF A SOFTWARE-MEDIATED PROCESS ASSESSMENT APPROACH IN IT SERVICE MANAGEMENT

A Thesis submitted by

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Abstract

To operate in a highly competitive business environment, organisations require the support of continually improving IT services. The dominant academic literature on IT Service Management (ITSM) focuses on the measurement of the outcome of ITSM implementation. Consequently, there is limited research on the measurement of ITSM processes. The ITSM industry has defined a number of processes as best practices in the IT Infrastructure Library (ITIL®) framework and the international standard for ITSM, ISO/IEC 20000. However, there is a lack of a transparent and efficient process assessment method to improve ITSM processes. This research aims to address the dual problems of the lack of transparency and the need for efficiency in ITSM process assessment.

Using the design science research methodology, an iterative design process was followed to develop a research artefact in the form of a method: the Software-Mediated Process Assessment (SMPA) approach that enables researchers and practitioners to assess the ITSM processes in a transparent and efficient way. The four phases in the SMPA approach include preparation for the assessment; online survey to collect assessment data; measurement of process capability; and reporting of process improvement recommendations. The international standard for process assessment ISO/IEC 15504 and associated assessment models provided support for a transparent method. A Decision Support System (DSS) was implemented to demonstrate efficient use of the SMPA approach. Using a theoretically-grounded fit profile based on the Task-Technology Fit theory, the international standards and DSS technology were implemented in the SMPA approach to address the research problem. The DSS platform was provided by an industry partner Assessment Portal Pty Ltd. that specialises in online assessment services.

Two case study organisations provided test sites for the evaluation of the SMPA approach. The two organisations are the Queensland Government's primary IT service provider, CITEC and the IT service department of an Australian local government authority, Toowoomba Regional Council. Using the quality models from the international standard for software quality evaluation ISO/IEC 25010, the usability and

outcomes of the SMPA approach were evaluated. Evidence from the case study evaluations indicated that the SMPA approach is usable for ITSM process assessment in order to support decision-making on process improvements.

Further discussions of the research findings provided design knowledge that included the emergence of the concept of virtualisability in ITSM process assessments and a proposal of a hybrid ITSM process assessment method. Moreover, iterations of self-assessments of ITSM processes using the SMPA approach may facilitate continual service improvement. Based on the design knowledge obtained, the contributions of this research to theory and practice were articulated. The SMPA approach extends prior guidelines on ITSM process assessment by providing a fine-grained method to assess ITSM processes. The SMPA approach clarifies the impact of software mediation to support transparency and efficiency in the way process assessments are conducted. This research also demonstrates how the SMPA approach is applied in practice by enabling IT organisations to self-assess the capability of their ITSM processes.

Upon reflection, the design science research method was found to be highly suitable to develop an artefact to solve a research problem and to evaluate the practical utility of the artefact. The SMPA approach is a research artefact that is implemented as a DSS; hence it is readily accessible to practitioners. The focus on practical utility provides researchers with results that are more readily endorsed, thus maximising the impact of the research findings in practice.

Certification of Thesis

I certify that the ideas, results, analysis, and conclusion reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award. To the best of my belief, the thesis contains no material previously published or written by another person, except where due reference is made in the thesis itself.

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Candidate's Publication List

During the course of this research, a number of research and industry papers were published. The publication list follows next.

JOURNAL PUBLICATIONS

IJASM	Jäntti, M, **Shrestha, A** & Cater-Steel, A 2012, 'Towards an Improved IT Service Desk System and Processes: A Case Study', International Journal on Advances in Systems and Measurements, vol. 5, no. 3 and 4, pp. 203-15.
JITTA	**Shrestha, A**, Cater-Steel, A, Tan, W-G & Toleman, M 2015, 'A Method to Select IT Service Management Processes for Improvement', Journal of Information Technology Theory and Application, vol. 15, no. 3, pp. 31-56.
IJIDS (in press)	Cater-Steel, A, Valverde, R, **Shrestha, A** & Toleman, M (in press), 'Decision Support Systems for IT Service Management', International Journal of Information and Decision Sciences, Special issue on Group-based Decision and Knowledge Support Systems for Service Systems.

CONFERENCE PROCEEDINGS

ACIS 2012 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Tan, W-G & Toleman, M 2012, 'A Model to Select Processes for IT Service Management Improvement'. Proceedings of the 23rd Australasian Conference on Information Systems, Geelong, VIC, Australia.
ACIS 2014 Conference Proceedings	**Shrestha, A**, Cater-Steel, A & Toleman, M 2014, 'How to Communicate Evaluation Work in Design Science Research? An Exemplar Case Study'. Proceedings of the 25th Australasian Conference on Information Systems, Auckland, New Zealand.
DESRIST 2013 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Tan, W-G & Toleman, M 2013, 'A Decision Support Tool to Define Scope in IT Service Management Process Assessment and Improvement', in Design Science at the Intersection of Physical and Virtual Design, Springer-Verlag, Berlin, vol. 7939, pp. 308-23.
DESRIST 2014 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Toleman, M & Tan, W-G 2014, 'Building a Software Tool for Transparent and Efficient Process Assessments in IT Service Management', in Advancing the Impact of Design Science: Moving from Theory to Practice, Springer, pp. 241-56.

ECIS 2014 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Tan, W-G & Toleman, M 2014, 'Software-mediated Process Assessment for IT Service Capability Management'. Proceedings of the 22nd European Conference on Information Systems (ECIS 2014), Tel Aviv, Israel.
EMS 2014 Conference Proceedings	Valverde, R, Cater-Steel, A, **Shrestha, A** & Toleman, M 2014, 'Smart Tools for IT Service Management: A Review of Two Decision Support System Projects'. Proceedings of the 4th International Conference on Engaged Management Scholarship, Tulsa, OK, USA.
PROFES 2013 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Tan, W-G, Toleman, M & Rout, T 2013, 'A Tool for IT Service Management Process Assessment for Process Improvement', in Product-Focused Software Process Improvement, Springer, pp. 330-3.
SPICE 2013 Conference Proceedings	Cater-Steel, A, Tan, W-G, Toleman, M, Rout, T & **Shrestha, A** 2013, 'Software-mediated Process Assessment in IT Service Management', in Software Process Improvement and Capability Determination, Springer, pp. 188-98.
SPICE 2014 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Toleman, M & Rout, T 2014, 'Towards Transparent and Efficient Process Assessments for IT Service Management', in Software Process Improvement and Capability Determination, Springer International Publishing, pp. 165-76.
SPICE 2015 Conference Proceedings	**Shrestha, A**, Cater-Steel, A, Toleman, M & Rout, T 2015, 'Evaluation of Software Mediated Process Assessments for IT Service Management, in Software Process Improvement and Capability Determination, Springer International Publishing, pp. 72-84.

INDUSTRY PUBLICATIONS & PRESENTATIONS

itSMF Bulletin	**Shrestha, A**, Collins, P & Cater-Steel, A 2013, 'ITSM Process Assessments using ISO/IEC 15504 for CSI', Informed Intelligence: itSMF Australia Bulletin, pp. 10-1.
itSMF Queensland Seminar	**Shrestha, A**, Cater-Steel, A & Kennedy, G 2013, 'Do you want to drive CSI? Harness ISO/IEC 15504', itSMF QLD Seminar, Brisbane, Australia.
itSMF National Conference	**Shrestha, A** & Kennedy, G 2014, 'Consistent! Transparent! D.I.Y. ITSM Process Assessment Approach', itSMF LEADit conference, 13-15 August, Melbourne, Australia.

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Special thanks to my parents, Arun and Manika, for the true value of hard work they bestowed on me from my early life. This thesis is especially dedicated to my little baby Aadi who was born when I was beginning to put all my writings together to compile this thesis. Aadi has kept me going with his lovely smile from the day he arrived. Finally to the love of my life, Deepa, for her enormous sacrifices and patience with me throughout this project.

“व्यये कृते वर्धत एव नित्यं विद्याधनं सर्वधनप्रधानम्॥”

(Knowledge is the only thing in the world that accumulates when spent.)

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List of Abbreviations

Abbreviation	Full form
ACIS	Australasian Conference on Information Systems
AF	Assessment Facilitator
AHP	Analytical Hierarchy Process
AIDA	Assessment and Improvement Integrated Approach
AISeL	Association for Information Systems Electronic Library
AP	Assessment Portal
ARC	Australian Research Council
AS	Assessment Sponsor
ASQ	American Society for Quality
AUD	Australian Dollar
B2B	Business-to-business
BAS	Budgeting and Accounting for IT Services
BRM	Business Relationship Management
BSI	British Standards Institution
CaM	Capacity Management
ChM	Change Management
CITIL	CMMI and ITIL
CL	Capability Level
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
CMMI-SVC	Capability Maturity Model for Services
COBIT	Control Objectives for Information and Related Technology
CoM	Configuration Management
CoV	Coefficient of Variation
CSI	Continual Service Improvement
DESRIST	Design Science Research in Information Systems and Technology
DnK	Don't Know
DnQ	Don't Understand the Question

DOI	Diffusion of Innovations
DSITIA	Queensland Government Department of Science, Information Technology, Innovation and the Arts
DSR	Design Science Research
DSRM	Design Science Research Methodology
DSS	Decision Support System
DTS	Draft Technical Specification
ECIS	European Conference on Information Systems
EDP	Electronic Data Processing
EFQM	European Foundation for Quality Management
EMS	Engaged Management Scholarship
EPS	External Process Stakeholder
GQM	Goal-Question-Metric
GU	Griffith University
HP	Hewlett Packard
HTRI	Henri Tudor Research Institute
IBM	The International Business Machines Corporation
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IJASM	International Journal on Advances in Systems and Measurements
IS	Information Systems
ISACA	Information Systems Audit and Control Association
ISM	Information Security Management
ISO	International Organisation of Standardisation
ISRM	Incident and Service Request Management
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITSM	Information Technology Service Management
itSMF	Information Technology Service Management Forum
JITTA	Journal of Information Technology Theory and Application

KISMET	Keys to IT Service Management Excellence Technique
KPI	Key Performance Indicator
MIS	Management Information Systems
MOF	Microsoft Operations Framework
MSF	Microsoft Solutions Framework
NA	Not Applicable
NEOMI	*Nouvelle Organisation de l'Exploitation et de la Maintenance Informatiques*
NiCE	NOVE-IT Capability Determination
NPLF	Not, Partially, Largely, Fully
OGC	Office of Government Commerce
PA	Process Attribute
PAM	Process Assessment Model
PDCA	Plan-Do-Check-Act
PDF	Portable Document Format
PM	Problem Management
PM	Process Manager
PMBOK	Project Management Body of Knowledge
PMF	Process Maturity Framework
PP	Process Performer
PRINCE2	Projects In Controlled Environments 2
PRM	Process Reference Model
PROFES	Product Focused Software Development and Process Improvement
PVT	Process Virtualization Theory
QFD	Quality Function Deployment
RDM	Release and Deployment Management
RQ	Research Question
SB	Service Beneficiary
SC	Sub-Committee

SCAM	Service Continuity and Availability Management
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
SEI	Software Engineering Institute
SERVQUAL	Service Quality
SLM	Service Level Management
SM	Supplier Management
SM	Service Manager
SMPA	Software-mediated Process Assessment
SMS	Service Management Systems
SPI	Software Process Improvement
SPICE	Software Process Improvement and Capability Determination
SPINI	Software Process Improvement Initiative
SQL	Structured Query Language
SQuaRE	Systems and Software Quality Requirements and Evaluation
TAM	Technology Acceptance Model
TIPA	Tudor IT Process Assessment
TQM	Total Quality Management
TR	Technical Report
TRC	Toowoomba Regional Council
TSO	The Stationery Office
TTF	Task-Technology Fit
USA	The United States of America
USQ	University of Southern Queensland
VSE	Very Small Enterprises
WG	Working Group

Chapter 1. Introduction

1.1 Chapter Introduction

This research developed and evaluated a software-mediated process assessment (SMPA) approach that is proposed to improve management processes of Information Technology (IT) services in a more transparent and efficient way than current process assessment methods. The SMPA approach is proposed as the research artefact. This research was conducted at the University of Southern Queensland (USQ) and was funded by an Australian Research Council (ARC) industry linkage grant in partnership with an assessment software company: Assessment Portal Pty Ltd (AP). This research project also had support from Griffith University (GU) in Brisbane, Australia, in the form of access to an expert in the international standard for process assessment, ISO/IEC 15504.

Figure 1.1 presents an overview of Chapter 1.

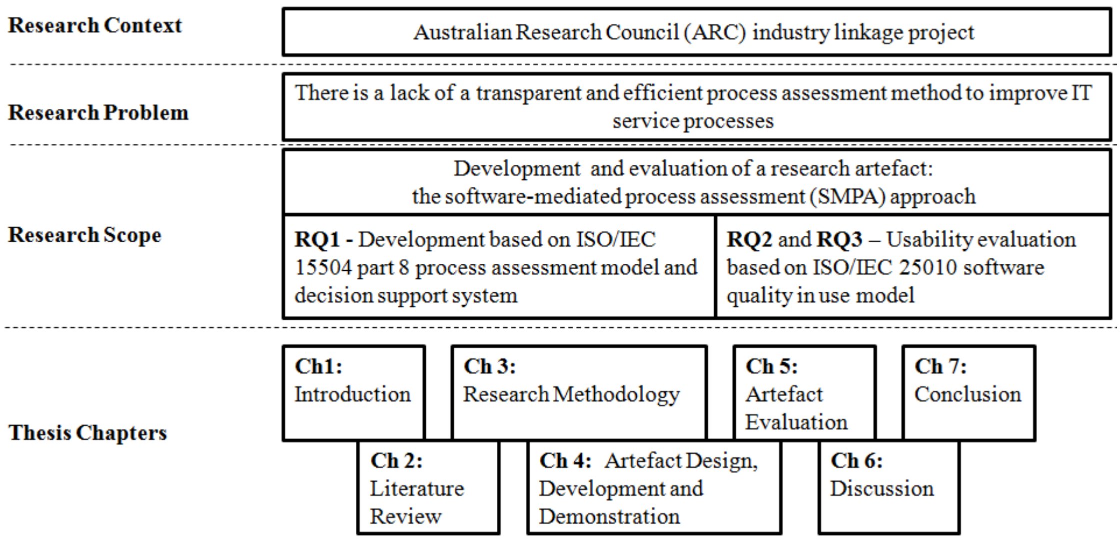

Figure 1.1 Chapter 1 Overview

Two case study organisations provided test sites for implementation and evaluation of the research artefact. The two organisations are the Queensland Government's primary IT service provider, CITEC and the IT service department of an Australian local government authority, Toowoomba Regional Council (TRC ICT). A multi-party agreement for the research project between five research partners – USQ, GU, AP, CITEC and TRC ICT – was established in 2009. After the appointment of this researcher as a PhD candidate in the project, the three-year research work commenced in February 2012.

This section introduces the research project. Background information relating to existing methods of process assessments in the discipline of IT service management (ITSM) is provided, highlighting the motivation behind the development of a transparent and efficient process assessment approach in *section 1.2*. Next, the research problem and associated research questions are stated in *section 1.3,* followed by the justification of this research in *section 1.4*. The research methodology is then outlined in *section 1.5* and definitions are provided for an understanding of the key concepts in *section 1.6*. Finally, the scope delimitations and key assumptions are stated in *section 1.7* and the format of this thesis is outlined in *section 1.8*. *Section 1.9* provides the chapter summary as the conclusion to this chapter.

1.2 Background and Motivation

This section sets the scene for a critical understanding of the research context. IT services are important: according to research conducted by Gartner, investment in IT services exceeded that in IT devices, data centre systems and enterprise software in 2014 and is forecast to continue (Drew 2014). Other research has shown that 60-90 percent of the total cost of IT ownership is concerned with the IT services (Galup et al. 2009). It is certain that businesses will increasingly evaluate IT in terms of the value offered by IT services rather than how the technologies are managed. The value of IT to business is intertwined with the understanding of business since IT is deeply embedded in business processes (Kohli & Grover 2008). The ITSM discipline has embraced a process approach along with service-oriented thinking to manage IT for businesses. The ITSM model deviates from the technology view and instead focuses on customer service (Keel et al. 2007). Management of IT services, therefore, is a crucial requirement for modern business operations.

To provide guidance for implementation of the ITSM model, most organisations have chosen the IT Infrastructure Library (ITIL®) framework (Bernard 2012). The ITIL framework was initially created by the UK government in the late 1980s (TSO 2011). Under the influence of the internationally active IT service management forum (itSMF) the ITIL framework has gained worldwide acceptance among private as well as public sector organisations (Clacy & Jennings 2007; Lahtela & Jäntti 2010). Research carried out around the world has confirmed that organisations have benefited from adopting this framework (Cater-Steel & McBride 2007; Hochstein, Tamm & Brenner 2005; Potgieter, Botha & Lew 2005). The ITIL framework eventually led to the creation of the international standard for ITSM: ISO/IEC 20000 (ISO/IEC 2011b). It is important to note the difference between ITIL and ISO/IEC 20000: the former is a framework that provides guidance to follow good practice in IT services while the latter is the official standard for ITSM from the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC). ISO/IEC 20000 provides a set of criteria for audit and certification of ITSM. Both ITIL and ISO/IEC 20000 provide a process-oriented framework to implement ITSM for organisations.

The increasing role of ITSM to support business means ITSM processes should be continually improving (Barafort et al. 2009). In the current ITIL framework, Continual Service Improvement (CSI) has been proposed as an important service lifecycle phase. CSI emphasises that there should be an ongoing effort to identify opportunities for improvement in ITSM processes (Bernard 2012). The CSI concept further stresses that "continual assessment" begins after the operation of the new processes to identify improvement opportunities (Lloyd 2011, p. 48). This CSI requirement, which is consistent with the continual improvement principle of the ISO 9000 quality management standards, is also ingrained in ISO/IEC 20000 to the extent that one of the clauses mandates “there shall be a policy on continual improvement of the service management systems” (ISO/IEC 2011b, clause 4.5.5.1). Consequently, CSI is the cornerstone of effective ITSM implementation.

The purpose of CSI is to continually align and re-align IT services to changes in business conditions by identifying and making appropriate improvements to ITSM processes. CSI therefore, is not merely a concept but is crucial to the business as it deals with the continuing relevance and responsiveness of IT services to customers. CSI activities, however, are expensive as they are resource intensive (Lloyd 2011). Moreover, process improvement programs may be difficult to sustain and may even regress over time if they are not effectively managed (Harkness, Kettinger & Segars 1996; Juran & Godfrey 1999; Keating et al. 1999; Khurshid & Bannerman 2014). To simplify CSI activities many organisations have adopted process assessment techniques that call for a systematic measurement of processes (Van Loon 2007). The measurement results are then used to continually improve the processes. Process assessment, however, needs to be differentiated from audit: while the quality standard ISO 9001, for instance, can be used to conduct audits by checking conformance (Barafort, Di Renzo & Merlan 2002), process assessment goes one step beyond conformance checks and provides evaluation of process capabilities on a continuous scale (Rout et al. 2007). This fundamental difference is reflected in the role and attitude of the assessors. Hence, standard process assessments can measure improvement in ITSM processes.

Organisations would normally engage consulting firms to perform process assessments and to recommend ITSM processes that require improvement (Barafort et al. 2009). However, qualified and experienced ITSM consultants can be expensive and scarce. It is reported that process assessments are costly and time-consuming (Fayad & Laitinen 1997; Lloyd 2011; Peldzius & Ragaisis 2013). Therefore, ensuring process assessments are cost effective is a serious challenge for organisations. In addition, assessment outcomes are often dictated by proprietary methods and tools employed by the assessors of consulting firms (Bernard 2012). ITSM process assessment needs to be transparent in order to provide confidence in the assessment process and outcomes. The lack of transparency and increasing costs deter organisations from regular and consistent ITSM process assessments for CSI. These are the two challenges confronted by IT organisations in the present day.

From a review of the literature, little research has proposed a solution to the challenges of ITSM process assessment. Consequently, the literature review led to research opportunities to develop a transparent and efficient process assessment method. The key motivation to conduct this research is to exploit the identified research opportunities and to propose a new process assessment method that can resolve the challenges of existing process assessment methods. A standards-based approach and use of a Decision Support System (DSS) are two major drivers of this research for the development of a transparent and efficient ITSM process assessment method.

The best practice guidelines in ITIL discuss drawbacks of conducting process assessments such as high costs, risks of non-acceptance and the lack of objectivity (Lloyd 2011). However there is no solution presented to address these shortcomings. Existing ITSM process assessment approaches, such as Tudor IT Process Assessment (Barafort et al. 2009) and ITIL Process Maturity Framework (MacDonald 2010), use proprietary process assessment models to assess compliance against the ITIL framework. Even though ITIL provides best practice guidelines to conduct process assessments, it is not designed as a unit of measurement for process assessments (Lloyd 2011). Therefore, the metric of "ITIL compliance" can be misleading since such assessments lead to evaluating ITIL alignment rather than process improvements in ITSM. Moreover, there is ambiguity in different assessment methods due to the lack of a transparent assessment method (Lloyd 2011).

An alternative to relying on expensive consultants who use their proprietary process assessments is for organisations to carry out a transparent process assessment themselves using a DSS that may be integrated with a knowledge base of ITSM best practices. This involves appointment of an internal team of assessors to undertake assessment based on an acceptable standard, aided by a DSS and with minimal or no outside assistance. Risks of internal self-assessments include the lack of objectivity, limited acceptance of findings, internal politics, limited knowledge or skills, and distraction from the regular work (Lloyd 2011). These risks demonstrate the need for efficiency in terms of time and resources required to conduct ITSM process assessments. In order to address the need for efficiency, a DSS can implement a standards-based assessment method to plan process assessment projects, collect assessment data, calculate process capabilities and provide improvement recommendations. This opportunity provides motivation to develop a novel method for ITSM process assessment. As a result, a method called **Software-mediated Process Assessment (SMPA)** is proposed.

> **The SMPA approach is a standards-based process assessment method by which organisations can self-assess their processes in a transparent and efficient manner using a decision support system.**

The international standard for process assessment: ISO/IEC 15504 (ISO/IEC 2004b) is used to guide the activities of the SMPA approach. The standard originated from the software engineering discipline and was originally called Software Process Improvement and Capability dEtermination (SPICE). In recent years the standard has been broadened to address non-software domains such as management systems, banking, automotive, medical devices and aerospace (Cortina et al. 2014; Di Renzo et al. 2007; McCaffery, Dorling & Casey 2010; Rout et al. 2007; Van Loon 2007). Consequently, the ISO/IEC 15504 standard is in the process of transformation from a single, multi-part standard into a family of related standards covering a range from ISO/IEC 33001 to 33099 (Rout 2014). At the time of writing (January 2015), eight parts of the new ISO/IEC 330xx standard family are under development and only one Part (ISO/IEC TR 33014) was published in 2013. However, most parts of the ISO/IEC 15504 standard are still active and at the "Published" stage. Therefore this research uses ISO/IEC 15504 as the international standard for process assessment as it currently stands. Nevertheless, a note is made that in the very near future, it is expected that the ISO/IEC 15504 standard will no longer exist and will be replaced by a family of ISO/IEC 330xx standards.

The ISO/IEC 15504 standard is particularly valuable in improving non-software processes as these processes tend to be more "repetitive and stable" than those pertaining to software (Coletta 2007, p. 319). The application of the standard in ITSM is relatively new (Mesquida et al. 2012). An exemplar process assessment model for ITSM has been published as a Part of the ISO/IEC 15504 standard (ISO/IEC 2012b). This research demonstrates development of the SMPA approach based on the published assessment model and guidelines from the ISO/IEC 15504 standard to conduct transparent process assessments in ITSM.

This research project is undertaken in collaboration with academics, ITSM practitioners and standards committee members with combined expertise in ITIL, ISO/IEC 20000 and ISO/IEC 15504. Since this project is based on an ARC research proposal, the research problem, research questions and objectives were determined as part of the ARC linkage project proposal. The next section states the research problem and the three research questions developed to address the research problem.

1.3 Research Problem and Research Questions

After an introduction of the research context and an understanding of the motivation behind this research, the objectives of the research are twofold:

a) To address the lack of transparency in process assessments using an assessment model based on an international standard; and
b) To demonstrate self-assessments using a decision support system as an efficient method for IT service organisations.

Based on the objectives, the research problem can be formulated as below:

> **There is a lack of a transparent and efficient process assessment method to improve ITSM processes.**

To address this research problem, an understanding of the challenges of the existing process assessment methods is required. The development and evaluation of the SMPA approach is demonstrated to solve the research problem. This leads to the overarching research question for this research:

> **How can a Software-Mediated Process Assessment (SMPA) approach be developed and used by IT service providers for transparent and efficient process assessment?**

In view of the centrality of this research question, it was iteratively reviewed as the exploratory research unfolded. The overarching research question is broken into three specific research questions (RQ1 to RQ3) for granularity and clarity.

The ISO/IEC 15504 standard is founded on the principles of process improvement and is applicable to all types and sizes of organisation (ISO/IEC 2004b). The lack of transparency in the assessment method has already been noted as a key challenge in ITSM process assessment in *section 1.2*. This challenge is demonstrated in detail in Chapter 2 Literature Review. In order to address this challenge, significant work has been conducted by researchers at the Henri Tudor Research Institute (HTRI) (Barafort et al. 2009; Barafort et al. 2005; Barafort, Di Renzo & Merlan 2002; BarafortJezek, et al. 2008) who used ISO/IEC 15504 to produce repeatable and objective ITSM process appraisals. Research conducted at HTRI has been commercialised as Tudor IT Process Assessment (TIPA) framework using ITIL as the process reference model for assessment. Another significant development is the publication of Part 8 of the ISO/IEC 15504 standard that provided an exemplar process assessment model for ITSM (ISO/IEC 2012b). However as Chapter 2 demonstrates, there is no apparent research on the use of the assessment models to devise a transparent and efficient method in process assessment. In the context of recent developments of assessment models from the international standards community, the first research question (RQ1) seeks to report the development of the proposed SMPA approach.

> **RQ1: How can a Software-Mediated Process Assessment (SMPA) approach be developed for transparent and efficient process assessments in IT service management?**

It was found that the process assessment model and guidelines based on the international standard for process assessment ISO/IEC 15504, along with a number of other relevant frameworks and a DSS, provided support to develop the SMPA approach that is more transparent and efficient than current ITSM process assessment methods.

Past research has shown that innovative IT projects that alter existing practices, such as the introduction of new methods and technologies, are inherently problematic in implementation and may not yield the expected results (Nelson 2007). In such initiatives, organisations are presented with challenges that are not only related to the technology in question but are organisational in nature (Lai & Mahapatra 1997). The second research question (RQ2) focuses on the evaluation of the SMPA approach.

> **RQ2: How fit for use is the SMPA approach in IT service organisations?**

This research question is answered at appropriate points during implementation and evaluation of the SMPA approach at the two case study organisations. The ISO/IEC 25010 standard includes a software quality in use model that provides several evaluation factors of use of software (ISO/IEC 2011a). Five factors were used for the evaluation of the SMPA approach. It was concluded that use of the SMPA approach enabled effective, efficient and trustworthy process assessments at the case study organisations. However, the SMPA approach was not considered useful under certain circumstances. A detailed evaluation of the fit for use of the SMPA approach is presented in Chapter 5 Artefact Evaluation.

Following from RQ2, the final research question (RQ3) asks about the evaluation of the outcome of the SMPA approach.

> **RQ3: How fit for use is the outcome of the SMPA approach (assessment report) to support decision-making on process improvements?**

Outcomes of ITSM process assessment methods are largely dependent on the activities defined in the method. If the activities are designed around a proprietary framework, they tend to behave as a “black box”, as the rationale behind the analysis may not be disclosed to assessors or to the assessment sponsor. In this case, assessors and assessment sponsors are unable to ascertain the validity of the recommendations, nor can they compare their assessments with that of their peers who may have used a different approach. Existing ITSM process assessment methods lack transparency that stymies replicability, reliability and consistent benchmarking of assessment results. The advantage offered by ISO/IEC 15504 is the uniformity and objectivity in the assessment method. The use of a DSS can further enhance efficiency in the way the assessment method is conducted. It was found ITSM process managers expected they can make effective, useful and trustworthy decisions on process improvement using the assessment report. However the assessment report was considered inefficient in terms of time and effort required to support decision-making on process improvements. A detailed account of the evaluation of the SMPA outcome is presented in Chapter 5 Artefact Evaluation.

1.4 Justification of the Research

Moving from the explicit understanding of the research questions in the previous section, this section justifies the need for the research and provides an overview of expected contributions to research and practice. Research on IT management in organisations has a predominant focus on strategic issues such as business-IT alignment (e.g. Luftman 2000) or IT governance (e.g. Brown & Grant 2005; Ridley, Young & Carroll 2004). ITSM, on the other hand, focuses on service delivery and improvement that sits at the operational management level. Even though the service concept has been recognised to have important strategic implications (Cannon 2011), ITSM has received limited academic interest regardless of growing industry adoption (Galup et al. 2007; Winniford, Conger & Erickson-Harris 2009). A review of recent ITSM research literature provides a research agenda to focus on new ITSM implementations (Proehl et al. 2013) and demonstrates a lack of theoretically-driven research (Shahsavarani & Ji 2011). Consequently there is a need for academic research on innovative ITSM initiatives and their real-life implications.

Academic research on IT service quality has concentrated on conducting gap analysis between customer expectations and perceived service quality using a service quality instrument from the marketing discipline called SERVQUAL (Parasuraman, Zeithaml & Berry 1985). One of the most prominent Information Systems (IS) journals, *MIS Quarterly* featured several articles discussing the application of SERVQUAL as an IT service quality measure (e.g. Dyke, Prybutok & Kappelman 1999; Jiang, Klein & Carr 2002; Kettinger & Lee 1994, 2005; Pitt, Watson & Kavan 1995; Watson, Pitt & Kavan 1998). Since the fundamental measure of the SERVQUAL model examines the gap between the customer’s service expectation and perceived service delivery, it focuses on the extrinsic quality of IT services after the service is delivered. There is a lack of research on the intrinsic service attributes relating to the activities undertaken before or during IT service delivery. In other words, there is a lack of research in ITSM process measurement (Lepmets et al. 2012).

Business users rely upon IT services to accomplish their tasks. It therefore makes sense that examining how a user works, i.e. processes, is an important measure of IT service quality from a business perspective. Internal business processes are presented as one of four strategic pillars for business performance management in the Balanced Scorecard (Kaplan & Norton 1992). However, limited process measurement initiatives for IT service quality are reported in the literature and most frameworks borrow concepts from the software engineering discipline (Lepmets et al. 2012; Mesquida et al. 2012). It can be concluded that academic research regarding a transparent method to measure ITSM process is scant.

One of the methods to determine IT service process quality is process assessments to determine process capability by checking compliance with a standard (Cortina 2010). Academic research on methods to measure IT service process quality is limited. In the ITSM industry, several frameworks and commercial offerings are available for ITSM process assessments such as Tudor IT Process Assessment (Barafort et al. 2009), ITIL self-assessment services (Rudd & Sansbury 2013) and PinkSCAN assessments

(PinkElephant 2014). However, ITIL presents drawbacks to process assessments including the lack of transparency and high costs (Lloyd 2011). No concrete solution is presented in the academic and/or practitioner community to address these shortcomings. Therefore, it is worthwhile to develop a transparent and efficient method to conduct ITSM process assessments.

This research addresses the need for academic research that can also be applied to practice, thus providing a rigour-relevance balance (Straub & Ang 2011) to propose a transparent and efficient method in ITSM process assessments.

1.4.1 Expected Contributions to Research

A number of process improvement methodologies such as ISO 9000, Total Quality Management, Six Sigma, Lean, and Agile have been proposed over the last few decades to enable better business performance in terms of process effectiveness and efficiency (Harrington 1991). Software developed to apply these methodologies, such as business process modelling tools, has expedited process adoption and improvement (Aguilar-Saven 2004). However, measurement of process improvement, i.e. process assessment, lacks transparency since assessments are "vendor or framework dependent" (Lloyd 2011, p. 76). The lack of a software-mediated approach to conduct process assessments may be attributed to the failure to apply a standard model to conduct process assessments. Moreover, Lloyd (2011, p. 74) suggested that process assessments involve "real costs, staff time and management promotion". It is reported that process assessments are costly and time-consuming (Fayad & Laitinen 1997; Lloyd 2011).

To operate in a highly competitive business environment, organisations require the support of continually improving services from their IT departments. Even though the primary objective of ITSM is to support business operations (Galup et al. 2009), the value of IT services for a better business-IT alignment has been reinforced at a strategic level (Luftman 2000). ITIL and ISO/IEC 20000 adopt the process approach principle of quality management (ISO 2012) in order to manage activities as processes. It is important to understand the benefits of ITSM processes to an organisation (McNaughton, Ray & Lewis 2010). However, process improvement initiatives are hindered by a lack of empirically validated yet actionable design theories for a transparent and efficient assessment of ITSM processes.

As reported earlier, the motivation for this research arose out of the dearth of academic research in the area of ITSM process assessment. In late 2012 ISO and IEC have published an exemplar process assessment model for ITSM based on the international standard for process assessment ISO/IEC 15504 (ISO/IEC 2012b). The process assessment standard is relatively new in the ITSM domain (Mesquida et al. 2012). Therefore the expected contribution of this research is to address the need for a more transparent ITSM process assessment method based on ISO/IEC 15504, thereby serving as an industry trial for the new standard assessment model.

1.4.2 Expected Contributions to Practice

In reviewing available literature, it appears that there is a strong desire to continually improve ITSM processes but the lack of a transparent assessment method, along with cost, time and resource constraints prohibits regular process assessments (Bernard 2012). A recent ITSM industry survey conducted in the USA confirmed this situation

(Mainville 2014). Not unexpectedly, the increasing popularity of ITSM is accompanied by a proliferation of software tools to support processes, e.g. incident management process is supported by service desk tools. These software tools are intended to expedite ITSM processes, however, little appears to be available to assist in process improvement of ITSM processes. Indeed the ITIL framework specifies that "technology will need to be in place for monitoring and reporting" so that process improvement can occur (Lloyd 2011, p. 164).

Moreover, there are heated discussions reported in the ITSM community against the use of existing ITSM process assessment approaches (England 2012; Kane 2012). High costs and time requirements have caused some researchers (Fayad & Laitinen 1997; Peldzius & Ragaisis 2013) to conclude that process assessments are wasteful. An important benefit of using a measurement instrument is to be able to evaluate it in a more transparent manner with the ability to store measurement outcomes (Hubbard 2010). The key driver of this research is to propose a better measurement instrument that supersedes the existing approaches for ITSM process assessments.

The expected contribution to practice is to address the challenges reported by ITSM practitioners regarding high costs and the lack of transparency of existing ITSM process assessment methods. Use of the international standard for process assessment ISO/IEC 15504 is expected to promote transparency in the method. This may enable practitioners to conduct consistent and replicable process assessments at a minimal cost. Ultimately the new method is expected to enable practitioners to focus on the actual process improvement efforts without worrying about the assessments since they "can become an end in itself rather than the means to an end" (Lloyd 2011, p. 76). Moreover, by proposing a fine grained and actionable SMPA approach, this research is expected to demonstrate a research practice that incorporates readily validated research artefacts that can be easily corroborated by practitioners.

In summary, justification of this research is presented in terms of its relevance to respond to the current industry challenges and in terms of its rigour to contribute to the wider body of knowledge with an empirically validated method. The research is also expected to contribute to practice since practitioners can receive information-intensive, unbiased, consistent and timely guidance in determining process capability to improve ITSM processes using a DSS.

1.5 Methodology

This section provides a brief overview of the Design Science Research (DSR) methodology chosen to address the research problem. Further details are provided in Chapter 3 Research Methodology.

To address the research problem stated in *section 1.3*, it was decided that a new and fine-grained ITSM process assessment method should be designed and evaluated. A design science approach places emphasis on achieving clarity in the goals and underlying theoretical constructs of a new artefact and carefully evaluating how well the new artefact meets those goals (McLaren et al. 2011). A DSR methodology is used to explicate the requirements and theoretical principles for a new method to assess ITSM processes. The method is proposed as the Software-Mediated Process Assessment (SMPA) approach.

This research follows the DSR concept (Gregor & Jones 2007; Hevner et al. 2004) because the primary goal of this research is to develop a new artefact. The artefact in this research is a method for ITSM process assessments based on the international standards and implemented using a DSS. The goal of this research project is to produce a research artefact that would improve the current environment in ITSM process assessments. Therefore, the DSR methodology is used for the development of the artefact.

Design science in IS research has been used most commonly for generating field-tested and theoretically-grounded knowledge for creating software applications (McLaren et al. 2011). This research demonstrates how design science is well-suited to develop a new method to solve existing organisational task challenges, i.e. ITSM process assessment. To guide the design and evaluation of the SMPA approach, a DSS was constructed and evaluated as an instrument to assess ITSM processes following the new method.

In summary, the guiding principles of DSR for artefact development and artefact evaluation are used to conduct this research.

1.6 Definition of Key Terms

Definitions adopted by researchers are often not uniform. Therefore, key terms that could be controversial if not explicitly defined are presented in this section for an understanding of the concepts and terminologies used in this research. The key terms are categorised based on the concepts relevant to the research questions next.

General Terms

IT Service Management (ITSM) – a service science discipline that manages IT operations in a process-oriented approach to ensure quality of IT services to customers (Galup et al. 2009).

IT Infrastructure Library (ITIL) – a set of best practices for IT Service Management (ITSM) that focuses on aligning IT services with the needs of business and is published in a series of five core publications each covering an ITSM lifecycle stage (Bernard 2012).

Continual Service Improvement (CSI) – a stage in the IT service lifecycle that focuses on the processes to improve the quality of services continually (Lloyd 2011); also the title of one of the five core ITIL publications.

Service Management System (SMS) – a management system to direct and control the service management activities of the service provider (ISO/IEC 2011b).

Terms relating to RQ1: How can a software-mediated process assessment (SMPA) approach be developed for transparent and efficient process assessments in IT service management?

Transparency – the perceived quality of intentionally shared information from a sender (Schnackenberg & Tomlinson 2014) – for process assessments, transparency is the degree of information availability and visibility during the assessment activities.

Efficiency – resources expended in relation to the accuracy and completeness with which users achieve goals (ISO 1998) – for process assessments, relevant resources can include time to complete the task (human resources), materials, and the financial cost of usage.

Process assessment – a disciplined evaluation of an organisation unit's processes against a Process Assessment Model (ISO/IEC 2005b).

Process Assessment Model (PAM) – a model suitable for the purpose of assessing process capability, based on one or more Process Reference Models (ISO/IEC 2005b).

Process Reference Model (PRM) – a model comprising definitions of processes in a life cycle described in terms of process purpose and outcomes, together with an architecture describing the relationships between the processes (ISO/IEC 2005b).

Software-Mediated Process Assessment (SMPA) – a standards-based process assessment method by which organisations can self-assess their processes in a transparent and efficient manner using a decision support system.

Terms relating to RQ2: How fit for use is the SMPA approach in IT service organisations?

Software Quality In Use – degree to which software can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use (ISO/IEC 2011a).

Usability – degree to which software can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO/IEC 2011a).

Effectiveness – accuracy and completeness with which users achieve specified goals (ISO/IEC 2011a).

Usefulness – degree to which a user is satisfied with their perceived achievement of pragmatic goals, including the results of use and the consequences of use (ISO/IEC 2011a).

Trust – degree to which a user or other stakeholder has confidence that software will behave as intended (ISO/IEC 2011a).

Comfort – degree to which a user is satisfied with physical comfort (ISO/IEC 2011a).

Terms relating to RQ3: How fit for use is the outcome of the SMPA approach (assessment report) to support decision-making on process improvements?

Assessment report – a report that presents the final process capability results and process improvement recommendations, typically submitted at the end of a process assessment exercise.

Expected decision quality – an expectation prior to making a decision regarding accuracy and reliability (Jarupathirun & Zahedi 2007) – in this research, the decision outcome is determined by the outcome of the SMPA approach, i.e. the assessment report.

Process improvement – actions taken to change an organisation's processes so that they can more effectively and/or efficiently meet the organisation's business goals (ISO/IEC 2005b).

1.7 Scope Delimitations and Key Assumptions

The previous section defined the key terms used in this research. This section explicitly states the key assumptions undertaken and scope delimitations for this research.

The research was limited in terms of geographic location, time and assessment models used. The SMPA approach only considered process assessment models from the international standards and focuses solely on the assessment of ITSM processes without any considerations of the assessment of ITSM staff, ITSM technologies used or service as a whole (Lloyd 2011). In this research, the SMPA approach is developed and evaluated at two public-sector organisations in Queensland, Australia over a three-year period.

Due to the temporal constraints of the research study, only three ITSM processes defined in the ISO/IEC 20000 standard were assessed at each organisation. Both organisations nominated three processes for assessment as part of the scope for this research. Therefore, it was known that the maximum number of processes to be included in the development of the research artefact would not exceed six, i.e. if both organisations select three different processes. The two case study organisations selected two common processes and one process was different at each organisation. Consequently, a total of four ITSM processes provided a reasonable scope for this research. Including more processes would incur more time to develop the artefact and engagement of more process stakeholders to evaluate the artefact. However, this would be less fruitful since the effort would be on repetitive work of following the same method for more processes rather than the innovative work to develop the novel method. The focus is on the general assessment method applicable for all processes. Therefore, a method to select the most important ITSM processes to improve is an important decision for the organisations. This scoping activity is included in the first phase of the proposed SMPA approach.

Figure 1.2 illustrates the scope of this research and its key association with other important concepts that are beyond the scope of this research.

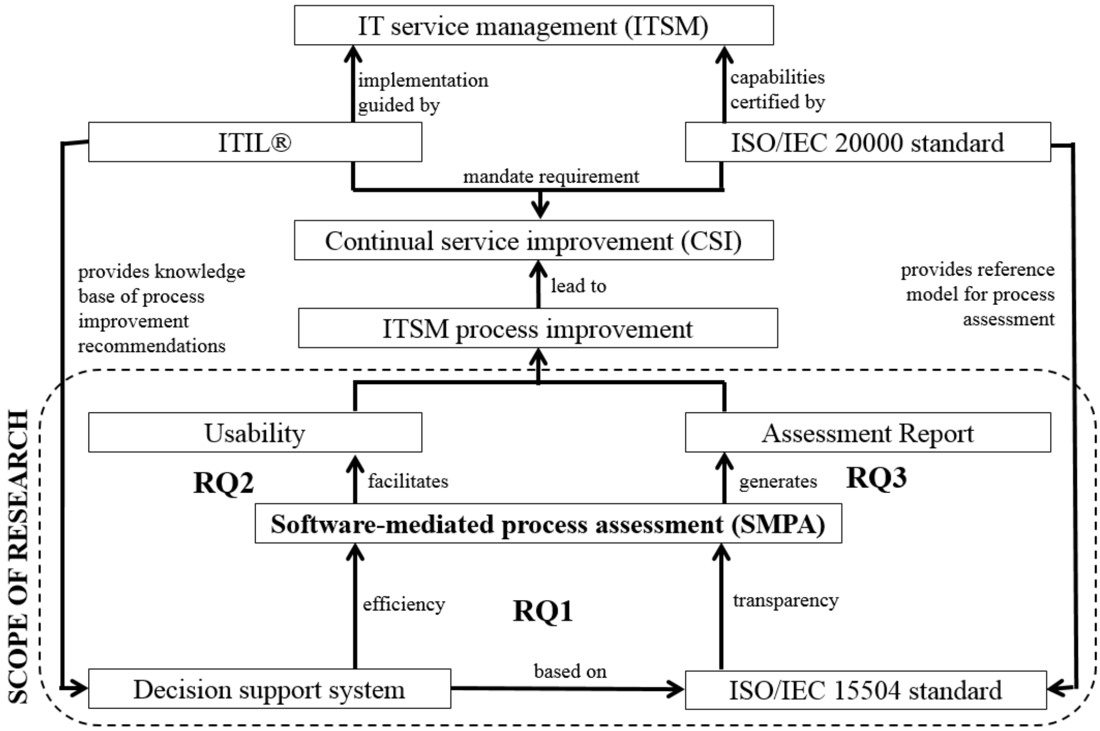

Figure 1.2 Scope of this Research

Moreover, Table 1.1 lists the scope delimitations for this project that provide a boundary on the areas of interest in this research. No claim of significance beyond the scope delimitations listed in Table 1.1 can be made in this research. Nevertheless, the research artefact promotes a general method to conduct process assessments that may be extended to assess other processes beyond the ITSM discipline. The unit of analysis in this research is the “method” of process assessment that can be applied at a “group level” since the artefact is used at an organisational unit.

Table 1.1 Scope Delimitations in the Research Activities

Scoping area	**Scope delimitation**
Artefact development	
Assessment area	Process capability
Assessment challenges	The lack of transparency and the need for efficiency
Process reference model	Four processes, as defined in Part 4 of the ISO/IEC 20000 standard
Process assessment model	Assessment model for ITSM, as defined in Part 8 of the ISO/IEC 15504 standard
DSS functionality	Process structuring and information processing dimensions, defined in the task-technology fit theory (Zigurs & Buckland 1998)
Artefact evaluation	
Industry sector	IT Service Management (ITSM) industry
Case study organisation types	Two public-sector organisations (CITEC and TRC ICT)
Case study organisation unit	External IT service provider (CITEC) and Internal IT service provider (TRC ICT)
Location	Queensland, Australia
Evaluation metric	Usability, as defined in the software quality in use model from the ISO/IEC 25010 standard

1.8 Outline of the Thesis

The thesis is structured based on the DSR publication schema proposed by Gregor and Hevner (2013) and has seven chapters.

Chapter 1 (this chapter) provides the background and motivation to undertake this research. Justification of the research, statement of research problem and research questions, overview of research methodology, key definitions and scope delimitations of the research are also provided.

Chapter 2 examines prior approaches in the research literature and practice for ITSM process assessments and highlights the gaps in literature to justify the research problem and its derivative research questions. A summary of current research is provided in order to identify research opportunities. Finally a case is made to develop the research model in order to proceed with the research work.

Chapter 3 describes the DSR methodology used in this research. The research philosophy, research design and research methods are described in detail, along with ethical issues considered in this research.

Chapter 4 outlines the phases of the SMPA approach in terms of the method description, DSS implementation and demonstration of the method at two case study organisations. This chapter also discusses the iterative design process and reports how the method has been developed thereby answering RQ1.

Chapter 5 describes the evaluation of the SMPA approach at two case study organisations. This chapter answers RQ2 and RQ3 by describing the evaluation findings regarding the usability of the SMPA approach and its outcome. A critical evaluation of the research method is also a part of this chapter.

Chapter 6 presents a discussion of the research findings. The chapter provides a critical examination of the research results with discussions based on the context of the research method and reviewed literature. Discussions are structured around the three research questions with a reflection on research work conducted and the presentation of key themes emerging from this research.

Chapter 7 summarises the findings of the research and how this research addressed the research problem. The contribution of research to the body of knowledge is discussed and implications of the research to theory and practice are presented. Then limitations of the research and directions for future research are presented.

1.9 Chapter Summary

This chapter laid the foundations for the thesis. The research background and motivation were presented for an overall understanding of the research context. Then the research problem and research questions were identified. Justification of the research and the research methodology was then briefly introduced. Key definitions and scope delimitations were provided before an outline of the thesis chapters. Upon this groundwork, the thesis can proceed with a detailed description of the research.

Chapter 2. Literature Review

2.1 Chapter Introduction

Chapter 1 introduced the research problem: there is a lack of a transparent and efficient process assessment method to improve ITSM processes. In this chapter, a theoretical foundation is built by reviewing the current literature to justify the research problem. As an outcome of this chapter, research opportunities that are not addressed by previous researchers and not exploited in practice are identified. This chapter provides a review of the literature that is aimed at fulfilling three objectives:

a) to develop a literature classification model for ITSM process assessment by reviewing the parent disciplines of "quality" and "service";
b) to review academic literature and industry practice surrounding ITSM process assessment in order to identify research opportunities; and
c) to introduce the Software-Mediated Process Assessment (SMPA) approach by reviewing the relevant international standards used in the method.

Finally, a research model is developed with research questions linked to the development and evaluation of the SMPA approach. Figure 2.1 presents an overview of Chapter 2.

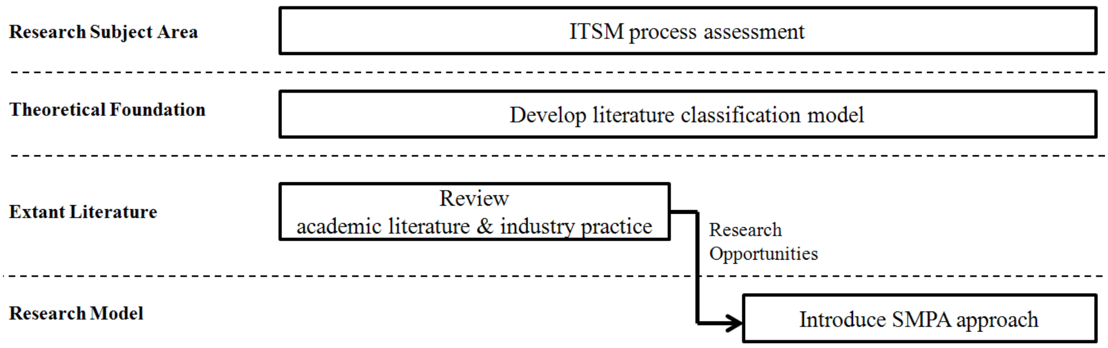

Figure 2.1 Chapter 2 Overview

This chapter has eleven sections. This section provides an introduction and outline to this chapter. *Section 2.2* discusses the literature review strategy and explains the process involved to review the literature. The next three sections develop the literature classification model for ITSM process assessment. The parent discipline of quality and guidance from Juran Quality Trilogy (Juran & Godfrey 1999) is discussed in *section 2.3*. Similarly *section 2.4* describes the concept of service before introducing the research area of IT service management. Finally *Section 2.5* describes the concept of ITSM process assessment.

Section 2.6 examines the academic literature on ITSM process assessment in detail. The existing ITSM process assessment methods used in practice are reviewed in *section 2.7*. Likewise *section 2.8* describes arguments for the development of the research problem along with theoretical justification. *Section 2.9* presents the two research opportunities that emerged from the research problem. Section *2.10* fulfils the third objective of this chapter by introducing the SMPA approach. A brief summary of relevant international standards used in the development and evaluation of the SMPA approach is provided.

Finally, *section 2.11* presents a conclusion and summary of the findings. A research model based on the three research questions introduced in Chapter 1 is also presented to guide this research forward.

2.2 Literature Review Strategy

The objective of the literature review is to obtain a detailed understanding of the current state of knowledge surrounding ITSM process assessment methods. Outlining the strategy for a literature review provides an evidence-based course of action for other researchers to follow and validate (Kitchenham et al. 2009). Explicit demonstration of the application of a literature review protocol (Table 2.1) ensures that the breadth of literature on the research subject area has been reviewed.

The literature review strategy used in this research is based on the steps suggested by Higgins and Green (2006): (a) define the search terms; (b) identify databases and search engines and query using the search terms; (c) create and apply the inclusion and exclusion criteria filters; and (d) verify the selection is representative. A literature review protocol was developed after the definition of key search terms for the research subject area of ITSM process assessments. Table 2.1 presents the literature review protocol used in this research.

Following the protocol presented in Table 2.1, it was found that there is a relatively significant body of literature that discusses ITSM and process assessment. However, the literature on the combination of these two disciplines was scarce since realisation of the benefits of this combination was first reported only in 2002 (Barafort, Di Renzo & Merlan 2002). The literature review initially resulted in 1,306 publications for process assessment and improvement. However, verification of the literature search by manual review of the searched publications resulted in filtering out a large number of studies in the discipline of business process management and software process improvement. Publications on service research in domains other than IT were also excluded. Only 32 academic publications were found to be relevant to ITSM process assessment methods.

Due to the scarcity of academic studies and the value of industry guidelines on the subject area of ITSM process assessment, quality literature on this subject from industry press were reviewed. A web search on the Google search engine was conducted for the keyword “ITSM Process Assessment”. The search led to a large number of results. Since Google presents search results based on relevance, the top 200 results were reviewed after which the results started to appear redundant and/ or irrelevant. A number of web search results provided insight into the current market offerings, case studies, white papers, electronic articles and reports about ITSM process assessment methods from industry press outlets such as itSMF publications, AXELOS knowledge centre and other ITSM related industry websites and blogs. Some prominent ITSM process assessment methods presented in the industry press were based on academic research. A few commercially successful ITSM process assessment methods were reviewed and discussed as well.

Table 2.1 Literature Review Protocol

Search terms	
Search keyword combinations	(“Process Assessment” **OR** “Process Improvement” **OR** “ISO/IEC 15504” **OR** “SPICE”) **AND** (“IT Service Management” **OR** “ITSM” **OR** “ITIL” **OR** “IT Infrastructure Library” **OR** “ISO/IEC 20000”)
General search (Online Databases and Search Engines)	
AIS Electronic Library (AISeL)	A central repository for research papers and journal articles relevant to the information systems academic community. http://aisel.aisnet.org/ (covers all major IS journals and AIS conference proceedings)
EBSCOhost MegaFILE Complete	Using EBSCOhost databases: • Academic Search Complete • Computers & Applied Sciences Complete • eBook Collection (EBSCOhost) Incorporating leading sources for academic journals from: • ACM Portal • IEEE Xplore • Springer Link • Decision Sciences • Elsevier • ScienceDirect • Wiley InterScience
Google Scholar	Extensive repository of scholarly publications
Specific search (research outlets that have a focus on the area of process assessments)	
EuroSPI Proceedings	European System & Software Process Improvement and Innovation Conference Repository http://www.eurospi.net/
SPICE Proceedings	Software Process Improvement and Capability dEtermination Conference Repository (in SpringerLink)
Standards On-Line Premium	Relevant ISO/IEC international standards
Search settings & selection criteria applied	
Language	English
Options	Scholarly (Peer reviewed) Publications, Full Text, References Available
Date range	Jan 1990 to Dec 2014
Inclusion criteria	Papers on ITSM and process improvement/ process assessment that explain: • General concepts • General applications • Overall implementation issues • Overall improvement aspects • Quality process improvement concepts • Continual/ continuous service improvement
Exclusion criteria	Papers on ITSM and process improvement/ process assessment that explain: • Specific ITSM processes or functions • Specific applications of ITSM other than improvement aspects • Specific applications of process improvement/ process assessment other than ITSM aspects • Software process improvement or software process assessment • Business process improvement or business process assessment

Sections 2.6 and 2.7 present the findings of the literature review on ITSM process assessment. Section 2.8 then presents the research problem associated with ITSM process assessment based on the literature review. Prior to this, a literature classification model comprising the parent discipline, literature domain and research subject area of ITSM process assessment is developed to underpin the position of ITSM process assessment in the literature. In the next two sections, the parent disciplines of quality and service are discussed first to articulate the literature classification model. The model positions ITSM process assessment in the academic literature.

2.3 Quality

Even after recognising that quality was becoming one of the competitive advantages for businesses as early as the 1980s, early researchers found it was very difficult to define quality. The concept of quality was thought to be "easy to visualize yet exasperatingly difficult to define. It remains a source of great confusion to managers …" (Garvin 1988, p. xi). More recently quality experts reiterated the ambiguity and difficulty in defining the term quality (Tague 2005; Tennant 2001). The ISO 9000 standard aims to provide a consistent terminology for quality management systems and defines quality as "the degree to which a set of inherent characteristics fulfils requirements" (ISO 2005). According to one of the world's leading evangelists for quality, Dr. Joseph Juran, quality means "fitness for use" where fitness is defined by the customer (Juran & Godfrey 1999). There are many definitions of quality (Garvin 1988) and it has been argued that one of the primary reasons for the lack of consistency in the definition of quality is because it can be studied from multiple perspectives (Steenkamp 1989). Therefore, the American Society for Quality defines quality broadly that it is a "subjective term" with two meanings in technical use: (a) product or service characteristics that satisfies stated or implied needs; and (b) product or service free of deficiencies (ASQ 2014). Most prior research has taken either a production-oriented or a customer-oriented approach to quality (Gummesson 1991).

The production-oriented approach reflects an operations management perspective and defines quality as "conformance to specifications" (Crosby 1979). Also referred to as technical quality, this approach is well suited to measuring the quality of standardised products (Kasper, Van Helsdingen & De Vries 1999). Dr. W. Edwards Deming explained the benefits of quality to businesses by linking quality improvement to decreasing costs and increasing productivity (Walton 1988). Deming went on to propose the continual improvement principle in quality management known as the P-D-C-A (Plan-Do-Check-Act) cycle. A similar philosophy is termed as *kaizen* in Japan which presents the Japanese philosophy of implementing continuous quality improvement (Masaaki 1986).

In contrast, the customer-oriented approach reflects a marketing perspective and views quality as subjective and determined by the perceptions of customers (Rust & Oliver 1994). In other words, quality is in the eye of the customer (Gummesson 1991). Drucker (2007) discussed the changing dimension of quality by defining it as an exercise of giving what a customer values. A two-dimensional view of the customer-oriented approach in quality explained the "must-be" quality and "attractive" quality to offer products and services that meet and exceed customer expectations (Kano et al. 1984). A thorough understanding of the concept of quality provides a broad and multidisciplinary view that covers among others, the management of products, services, people and processes involved (Drucker 2007). In the next section, quality management is discussed. Quality management emerged as a discipline to define and govern quality ingrained in business management activities.

2.3.1 Quality Management

The foundations of the quality management discipline emerged even before the concept of quality was defined. Considered as the father of scientific management, Frederick W. Taylor laid foundations of modern management with his publications on industrial efficiency concepts in the early twentieth century (Taylor 1913). Some of his management guidelines such as standardisation and improving processes apply well to the concept of quality management. Walter A. Shewhart is arguably the first noted quality expert who defined a method in quality management by proposing quality control mechanisms for production using statistical measures (Shewhart 1986). Since then, the quality management discipline evolved with the concept of statistical process control methods in the USA introduced by W. Edwards Deming (Austenfeld Jr 2001).

A number of highly successful quality management initiatives were instigated in Japan in the 1970s and 1980s. One of the notable developments was the method of Quality Function Deployment (QFD) to transform customer requirements into the design and manufacturing processes before final output is produced (Akao 2004). Toyota Production System was another quality management endeavour applied in production system (Ōno 1988).

Based on the teachings of quality leaders such as Philip B. Crosby, W. Edwards Deming and Joseph Juran, one of the first terms used to describe management approaches to quality improvement was Total Quality Management (TQM) (Powell 1995). TQM happens when all members of an organisation collectively work together to improve their products, services and processes (Ross 1999). In manufacturing processes, the concept of quality led to an initiative known as 'lean manufacturing' that focused on developing products to meet customer demand with little or no waste (Shah & Ward 2003). The management philosophy of lean led to the concept of Theory of Constraints proposed by Dr. Eliyahu M. Goldratt as a system improvement philosophy where specific process improvements must focus on the weakest link, i.e. the constraint of the system (Dettmer 1997). 'Six Sigma' was another quality concept initially developed by Motorola in 1987 to review the number of defects per million opportunities as a part of its long term quality program (Tennant 2001).

Even though the quality management discipline emerged from the development of quality practice over a century, it cannot be attributed to a single group, organisation or country (Tennant 2001). Evolving principles of quality management along with the globalisation of businesses led to the development of international standards for quality management, i.e. the ISO 9000 family which consists of some of the best known standards published by ISO (ISO 2012). The ISO 9000 standards primarily evolved to facilitate international trade since widespread national and regional quality system standards "were not sufficiently consistent in terminology or content for widespread use in international trade" (Marquardt & Juran 1999, p. 11.1).

The ISO 9000 standard series are based on eight quality management principles (ISO 2012). The principles can provide a framework to improve quality performance of any organisation. Three of the eight quality management principles: process approach; continual improvement; and factual approach to decision-making are highly relevant to this research. A detailed discussion of one of the quality management approaches, Juran's Quality Trilogy (Juran 1986) is provided next.

2.3.2 Juran's Quality Trilogy

Joseph Juran developed a cross-functional quality management approach called "The Quality Trilogy" that comprises three quality management processes: quality planning; quality control; and quality improvement (Juran 1986). The Juran Quality Trilogy is a universal framework of processes that can be applied to measure quality improvements. Measurement is considered as one of the most difficult tasks in quality management (Juran & Godfrey 1999). Measurement was traditionally conducted as part of quality control in manufacturing. However the concept of quality control has expanded to the management of quality for non-manufacturing industries as well. The quality management activities are grouped into three major processes as described in Table 2.2. The Juran's Quality Trilogy concept as presented in Table 2.2 is used in this research to develop the SMPA approach.

Table 2.2 Juran's Quality Trilogy (based on Juran 1986)

Quality Planning: Planning to define and meet quality goals
Establish quality goals
Identify customers
Select products/ processes based on customer needs
Quality Control: Evaluating actual performance by comparing performance with quality goals
Evaluate actual performance
Compare actual performance with quality goals
Act on the difference
Quality Improvement: Conducting improvement projects
Identify and implement the improvement projects
Business gains from quality improvement

The next section presents the concept of "service" which is the second parent discipline that informs this research.

2.4 Service

Consistent with the ambiguous definition of quality, there is a lack of consensus about what constitutes a service (Dumas et al. 2003). The "servitisation" of business (Vandermerwe & Rada 1989) led to the inception of the service economy where virtually all industries including IT are viewed as service businesses. In the discipline of marketing, Vargo and Lusch (2004) explored the evolving dominant logic of service provision being fundamental to economic exchange. The focus of service provision has since shifted from exchange to customer interactions where all goods are becoming "service-like" (Grönroos 2006).

Lehtinen and Lehtinen (1991) recommended two dimensions of quality in services: process quality and output quality of service production. While process quality is based on how the customer sees the service being offered (activities and interactions), output quality is evaluated from the result of the service production process (Lehtinen &

Lehtinen 1991). Swartz and Brown (1989) identified two dimensions of service quality: the "what" (i.e. evaluation of service after performance) and the "how" (i.e. evaluation of service during performance). These dimensions were expanded by Grönroos (1990) to three dimensions of service quality: *technical quality* refers to the outcome of the service; *functional quality* constitutes the process of service provision; and the corporate *image* builds upon the technical and functional qualities. This research is concerned with the functional quality aspects since the focus is on ITSM processes. The expansion of the service concept in all sectors of business triggered a need for service-oriented thinking in the field of IT and the discipline of ITSM evolved, which is discussed next.

2.4.1 IT Service Management

There are varied meanings of the term service in the IT/ IS literature. Business-to-Business (B2B) e-commerce views service as an activity performed in an organisation on behalf of a customer as abstraction of business processes (Dumas et al. 2003). In the area of database systems or computer networking, service could be seen as a set of software functionalities or components to facilitate certain applications, such as middleware services or web services (Bernstein 1996). This research focuses on the area of IT service which is service provided to customers by an IT service provider. An IT service is typically a combination of people, processes and technology and it should be defined with agreed levels of services to customers (TSO 2011). The use of IT to support business processes is crucial in the differentiation of IT services from a conventional definition of service (Spath, Bauer & Praeg 2011).

The broad scope of the service science literature creates a unique challenge in an environment of complex and interconnected service systems (Alter 2012). Among many different service management domains, the discipline of ITSM focuses on the design of IT services and links IT services with the business processes they are intended to support (Beachboard & Aytes 2011). The widely used ITSM framework, ITIL and the international standard for ITSM, ISO/IEC 20000 (ISO/IEC 2011b) promote standard best practices in ITSM processes that facilitate better business-IT alignment (Marrone & Kolbe 2011). It is reported that ITSM is an emerging area in industry but it has received limited academic attention (Galup et al. 2007; Winniford, Conger & Erickson-Harris 2009).

Early use of the term ITSM dates back to the 1980s and it is defined by a set of processes that ensures quality in IT services (Sallé 2004). According to Galup et al. (2009), ITSM is a subset of the service science discipline that manages IT operations in a process-oriented approach to ensure quality of IT services to customers. ITSM is often associated with the ITIL framework which is built around a process-based systems perspective of IT management (Galup et al. 2009). A number of primary studies related to ITSM project implementation are published. For example, case studies of critical success factors of ITSM implementation (Pollard & Cater-Steel 2009; Tan, Cater-Steel & Toleman 2009), lessons learnt from ITSM implementation (Tan et al. 2007), case studies of service issues from ITSM implementation (McBride 2009), ITIL implementation factors (Iden & Eikebrokk 2011; Iden & Langeland 2010), ITIL adoption and diffusion (Cater-Steel, Tan & Toleman 2009), ITSM implementation support (Deutscher & Felden 2010) and a systematic literature review on ITSM implementation (Iden & Eikebrokk 2013). These studies are related to overall organisational issues during implementation of ITSM.

The ITSM framework deviates from technology infrastructure management and focuses instead on quality delivery of IT services. ITIL 2011 edition (TSO 2011) and ISO/IEC 20000 (ISO/IEC 2011b) have confirmed the importance of the service management system as a continual service lifecycle model to deliver effective and efficient IT services. It is a well-established notion that effective ITSM implementation should continually improve IT service provision to business. The latest ITIL 2011 edition incorporates continual service improvement as one of the five service lifecycle phases (TSO 2011). The goal of continual service improvement is a major driver of this research and it is discussed next.

2.4.2 Continual Service Improvement

Continual Service Improvement (CSI) focuses on the processes to improve the quality of services (Lloyd 2011). It is important to note the difference between continuous and continual improvement. *Continuous* improvement focuses on constantly improving at the same level. *Continual* improvement, on the other hand, focuses on a sequence of improving quality as a succession in different time scales with progression to higher levels (TSO 2011). Continual service improvement, therefore, focuses on stages of improvement activities that enhance IT service quality.

There are a number of IS research articles that discuss process improvement as a key outcome from the implementation of IS projects. For instance authors on Enterprise Resources Planning (Holland & Light 1999); Information Management Systems (Sumner 1999); Six Sigma projects (Coronado & Antony 2002) and Total Quality Management projects (Antony et al. 2002; Porter & Parker 1993) have discussed an agenda on business process improvement in their research. Research studies on process improvement based on ITSM related projects are scarce. A paper by Cater-Steel and McBride (2007) examined ITSM improvement from the perspective of the role of communication in ITIL implementation, but it did not focus on ITSM process improvements. Process improvement is vital for the success of the entire ITSM model (TSO 2011) but apparently underrepresented in academic research.

From an investment point of view, ITSM represents a serious commitment by organisations. However it is still challenging to measure benefits of ITSM (Gacenga et al. 2011; Seddon, Graeser & Willcocks 2002). A cycle of planning, measuring, monitoring and implementing improvements is hence required and this cycle is prescribed in the CSI service lifecycle (Lloyd 2011).

CSI can be facilitated by the accumulation of individual process improvements in ITSM. Using an example of the problem management process of ITSM, Jäntti et al. (2007) suggested process improvement can be approached by a knowledge management model. In another paper (Jäntti & Pylkkänen 2008) they suggested a customer support model for process improvements. Diao and Bhattacharya (2008, p. 208) stated “As today’s IT service providers have very little visibility on their entire value network, it is hard to gauge the impact of singular process improvements”. In the evaluation of software quality, it is recognised that assessing and improving a process is a means to improve product quality, and evaluating and improving product quality is one means of improving the system quality (ISO/IEC 2011a). In the service management context, this can be recognised as assessing a process is a means to improve service processes, and evaluating and improving service processes is one means of improving service as a whole. The ITIL framework supports this notion by presenting a service lifecycle with continual improvement approach (ISO 2012).

CSI is inspired by Dr. W. Edward Deming's Plan-Do-Check-Act (PDCA) cycle developed in the 1980s (Moen & Norman 2006). The PDCA cycle has been adapted in the service management systems of ISO/IEC 20000 (ISO/IEC 2011b). The ITIL process for the CSI lifecycle phase is also based on the PDCA cycle and is called CSI 7-step improvement process (Lloyd 2011). The seven steps of the CSI improvement process in ITIL (Bernard 2012) can be mapped to Juran's Quality Trilogy as listed in Table 2.3.

Table 2.3 CSI mapped to Juran's Quality Trilogy

Juran's Quality Trilogy	**Continual Service Improvement**
Quality planning	**Service improvement planning**
Establish quality goals	Step 1: Identify improvement strategy
Identify customers	Step 2: Define what will be measured
Select products/ processes based on customer needs	
Quality control	**Service improvement activities**
Evaluate actual performance	Step 3: Gather the data
Compare actual performance with quality goals	Step 4: Process the data
Act on the difference	Step 5: Analyse the data
	Step 6: Present and use the information
Quality improvement	**Service improvement implementation**
Identify and implement the improvement projects	Step 7: Implement improvement
Business gains from quality improvement	

The concept of the PDCA cycle is central to CSI as it represents a wheel rolling up the slope of service improvement towards a greater maturity level along the horizontal time scale (Bernard 2012). Figure 2.2 is extracted from the ITIL framework and depicts the PDCA cycle in CSI.

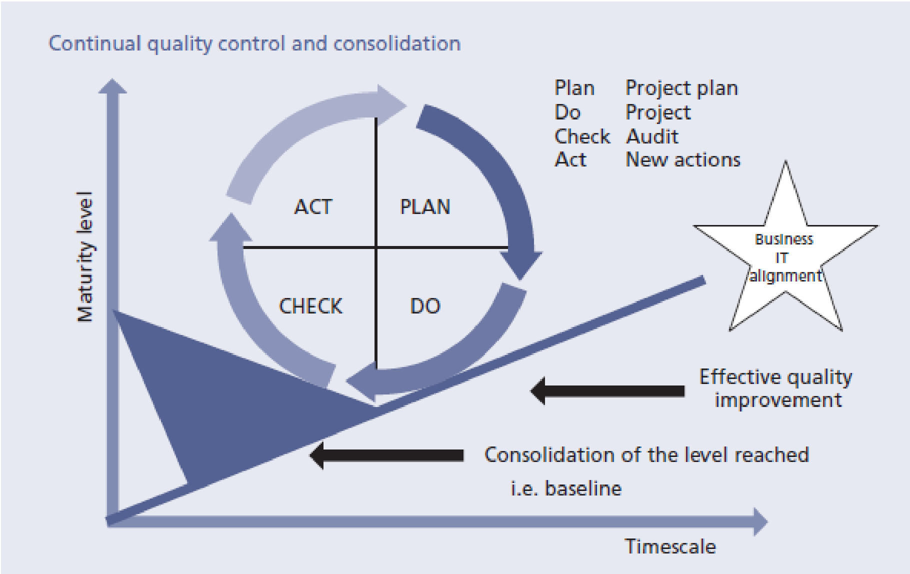

Figure 2.2 Plan-Do-Check-Act Cycle in CSI (Lloyd 2011)

Decision-making on CSI should be based on the current status of the measurable attributes of service quality (Lepmets et al. 2012). To measure CSI, there is a need to measure process improvements (Gacenga 2013; Lloyd 2011). The concept of ITSM process assessment is discussed next.

2.5 ITSM Process Assessment

A literature review on ITSM process assessment did not directly find its association with the parent literature even though its relationship with service and quality can be inferred based on the activities and goals of ITSM process assessment. In order to link ITSM process assessment to the wider body of knowledge, a literature classification model was developed in this research. The model illustrated in Figure 2.3 demonstrates that the literature review was constructively analytical rather than descriptive. The model also clarifies the role and position of ITSM process assessment emerging from two significant parent disciplines of quality and service. The literature classification model is one of the significant outcomes of the literature review to establish a concrete position of ITSM process assessment in the literature.

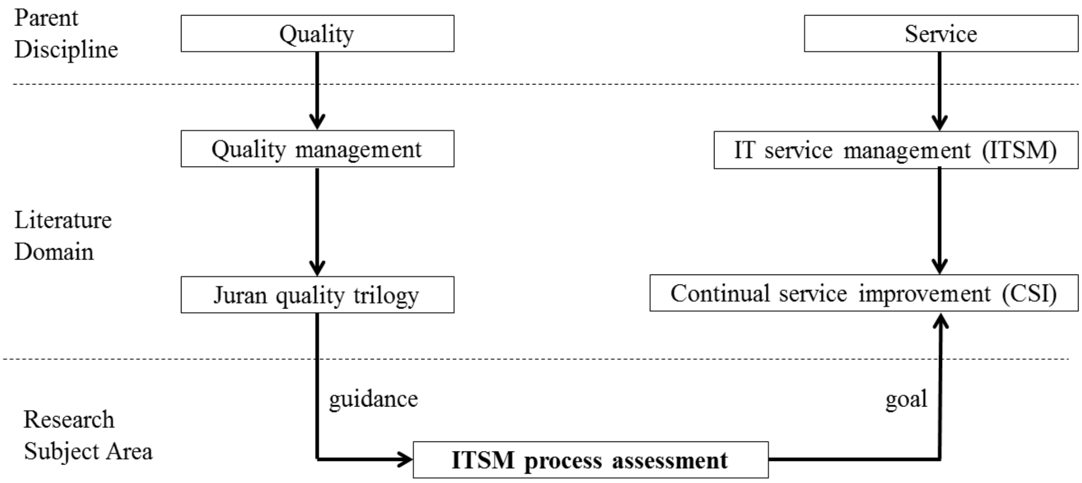

Figure 2.3 Literature Classification Model for ITSM Process Assessment

The literature classification model explicates the roots of ITSM process assessment in the literature. *Quality* concepts provide guidance in structuring and defining activities for ITSM process assessment. Juran's quality trilogy provides a broad set of activities that can guide the method of ITSM process assessments. Likewise emerging from the discipline of *service,* the concept of CSI is discussed as one of the important phases of ITSM. The primary goal of conducting ITSM process assessments is to facilitate CSI (Lloyd 2011). In this sense, ITSM process assessments can be associated with the discipline of service as well.

As a result, Figure 2.3 illustrates how the research subject area of ITSM process assessment is associated with the literature in the areas of quality and service. The concept of *ITSM* has already been discussed in *section 2.4.1*. The concepts of *process* and *assessment* are briefly discussed next before these three concepts combined, ITSM process assessment, is defined.

2.5.1 Process

One of the important principles of quality management is the process approach that advocates logical organisation of people, materials, energy, equipment and information into work activities designed to produce a required end result (Pall 2000). A process is a structured set of activities designed to accomplish a particular objective (TSO 2011). There are one or more defined inputs to a process that it turns into one or more defined outputs, and ultimately into an outcome.

A process must be measurable in order to be controlled and improved (Praeg & Schnabel 2006). It is critical that the measurement framework for process assessment is rigorously defined (Gacenga 2013). Before a process initiates, it must be demonstrated to be capable of meeting its quality goals. However, processes are prone to natural deterioration in the course of their evolution (Juran & Godfrey 1999). Therefore it is important to regularly assess the capability of processes. The concept of process assessment is explored next.

2.5.2 Process Assessment

The Merriam-Webster Online Dictionary defines assessment as the act of making a judgment about something (Merriam-Webster 2014). The term assessment has different meanings in different contexts such as tax assessments or student assessments. In the context of this research, assessments are activities associated with making a judgment about processes, i.e. how tasks are being done.

Process assessment is defined as an activity that aims to compare the actual processes performed in an organisation with reference processes that include typical activities for the process at different capability levels (Barafort et al. 2009). The anatomy of process assessment is very similar to that of audit (Rout et al. 2007). Both audit and assessment evaluate actual process capabilities and compare them with the process capability models. However, the primary purpose of process assessment is different to an audit. In process assessment, the main purpose is to provide process managers with guidance to help them improve their processes. However during process audits, people who may not be directly responsible for the process, such as senior management or external customers, seek information about the process capability to ascertain how well things are done and get assurance of quality work being done (Rout et al. 2007).

Organisations primarily have two reasons to conduct a process assessment (ISO/IEC 2004a). First, the organisation may want to demonstrate their process capability for certification as a quality IT service provider. Assessments are conducted as a formal audit in this scenario. Second, as is more often the case, the organisation wants the process assessment as a benchmark to compare itself with an international standard and as a yardstick in their process improvement journey (Juran & Godfrey 1999). Recognising these two broad objectives, the international standard for process assessment (ISO/IEC 15504) suggests process assessment can be performed either as part of a process improvement activity or as part of a capability determination initiative (ISO/IEC 2005a). Process assessment has a rich history in the area of software process improvement. The fundamental concepts in assessing processes emerged from the software engineering discipline, and then were subsequently applied in other non-software disciplines.

According to Juran and Godfrey (1999), a system of measurement consists of two elements: (a) a *unit of measurement*; and (b) an *instrument of measurement* to carry out the evaluation. The unit of measurement for ITSM process assessment is process capability and the instruments of measurement are different methods of ITSM process assessment. Process assessments have been proposed as a useful mechanism to improve IT service quality (Cortina et al. 2010). However formal process assessments for certification, such as class A CMMI appraisal and ISO/IEC 15504 certified process assessments, could be an expensive operation involving substantial costs as well as taking time of several employees over several days (Lloyd 2011).

Industry reports reveal that organisations prefer an easier, less costly and less time consuming process assessment method that can provide a reasonable indication of their process capability (Mainville 2014). This is particularly true for smaller organisations that are undertaking their first experience with assessments (Juran & Godfrey 1999). In this research, the requirement to be efficient is considered while proposing a new method of ITSM process assessment. Juran's Quality Trilogy discussed in *section 2.3.2* can be used to structure and define activities of ITSM process assessment. Table 2.4 illustrates the alignment.

Table 2.4 ITSM Process Assessment aligned with Juran's Quality Trilogy

Juran's Quality Trilogy	**ITSM Process Assessment**
Quality Planning	**Process Assessment Planning**
Establish quality goals	Establish organisation profile & assessment goals
Identify customers	Identify process stakeholders and their roles
Select products/ processes based on customer needs	Select critical processes to assess and improve
Quality Control	**Process Assessment Activities**
Evaluate actual performance	Data collection about actual process activities
Compare actual performance with quality goals	Calculate process capabilities
Act on the difference	Provide process improvement recommendations
Quality Improvement	**Service Improvement (post-assessment)**
Identify and implement the improvement projects	Identify and implement the process improvement projects
Business gains from quality improvement	Continual service improvement

Based on the literature classification model (Figure 2.3) and the activities defined for ITSM process assessment (Table 2.4), the following definition is proposed for ITSM process assessment:

> **A quality measurement method to determine process capabilities of IT services for continual service improvement.**

The literature review established a proliferation of ITSM metrics and IT service quality measures. However, ITSM practitioners are faced with challenges to assess ITSM processes in a cost-effective manner (Mainville 2014). There is also a lack of a structured process assessment method that is transparent and repeatable (Lloyd 2011). Academic researchers have focused on non-process dimensions of IT service quality (Lepmets et al. 2014). In cases where the process areas for IT service quality were discussed, the focus is more on the assessment models and frameworks rather than a method to consistently conduct ITSM process assessments. One of the principal measures of service improvement is to conduct repeated process assessments in ITSM (Lloyd 2011). However the lack of transparency and high costs impedes repeated process assessments which are detrimental to the success of CSI. In the next two sections, academic literature and current industry practice in ITSM process assessments are critically reviewed to articulate the literature gap and shortcomings in current practice.

2.6 Academic Literature Review on ITSM Process Assessment

As discussed in *section 2.5* and illustrated in Figure 2.3, the literature associated with ITSM process assessment is rooted in the concept of service and quality. Consequently, a review of the concept of IT service quality was conducted to search for methodological guidance to assess ITSM processes.

Consistent with the customer-oriented approach in quality, service quality is defined as the consumer’s overall impression of the relative inferiority/superiority of the service (Zeithaml 1988). Perhaps the most influential conceptualisation of service quality and a widely used measure to evaluate quality of service is the SERVQUAL instrument (Buttle 1996; Ladhari 2009). SERVQUAL has been used to measure and adapt service quality measurement in various service industries besides IT services, such as the health sector (Babakus & Mangold 1992; Kilbourne et al. 2004); banking (Zhou, Zhang & Xu 2002); retail services (Parasuraman, Zeithaml & Berry 1994); and library service quality (Cook, Heath & Thompson 2001). **Appendix A** (p. 242) provides a brief introduction to the SERVQUAL model. Dabholkar, Thorpe and Rentz (1995) summarised the lack of uniformity in measuring service quality and concluded that a consistent measure of service quality across all industries is infeasible. Regardless of worldwide recognition and adoption of specific service quality models in different domains, studies on consistent measurement of service quality are challenging and scant (Kang & James 2004).

Kettinger and Lee (2005) noted that IT departments are increasingly viewed as service providers to business users, and improving service quality and user satisfaction is a concern for IT researchers and practitioners. It was proposed that service quality, as a measure of IT effectiveness, be added to the DeLone and McLean (1992) IS success model to complement information quality and systems quality (Kettinger & Lee 1994; Pitt, Watson & Kavan 1995). In response to that, an updated version of the IS success model (Delone & McLean 2003) added service quality as a success dimension.

When the service quality construct was investigated in the IT field, most studies adopted the customer-oriented view of service quality (Lepmets, Ras & Renault 2011). IT service quality topics include the effect of IT-based services on service quality in the banking industry (Zhu, Wymer & Chen 2002), the use of IT to improve self-service options (Dabholkar 1996) and concepts to measure information systems quality (Kettinger & Lee 1994; Watson, Pitt & Kavan 1998). Walker, Johnson and Leonard (2006) provided two perspectives on service quality: from the view of the customer and from a service provider. A similar perspective echoed from Kang and James (2004). They differentiated service characteristics in two ways: what the customer wants; and what can be obtained by interacting with service providers. Parasuraman, Berry and Zeithaml (1993) realised the need to address both sides of the customer-server relationship and suggested that an over-emphasis on customer interaction means that improvement in service processes is under researched.

Existing work on IT service quality has adapted the SERVQUAL instrument (Parasuraman, Zeithaml & Berry 1985) to the context of IT service. Because the SERVQUAL model focuses on customers, IT service quality research has largely focused on business users to identify IT service quality problems, i.e. the measurement of the outcome of ITSM implementation. Consequently, there is limited research about what and how the service provider offers quality services, i.e. the measurement of ITSM processes (Lepmets et al. 2012).

While it is a well-agreed concept that service quality is ultimately determined by what the customer perceives, it is important that service providers understand the process of service activities since processes impact service delivery (Walker, Johnson & Leonard 2006). Proactive service management attempts to improve the process of service offerings separate to the outcome evaluation by customers (Lepmets et al. 2012). Organisations can conduct customer satisfaction surveys to assess the outcome of the service provision. However this is unlikely to assist service providers to improve the process of service provision (Jia & Reich 2011). There is a need for enterprises to redefine their processes regarding ITSM and to implement effective processes for IT service quality.

Therefore, IT organisations need to measure the capabilities of their service management processes and discuss ways processes can be improved for better service quality. For example, after identifying a service quality shortfall (the what), managers also need to find the root causes (the why) and implement appropriate corrective actions (the how): all of these can be defined in a process model. Existing literature of IT service quality has shown a lack of research on the topic of service process measurement (Spath, Bauer & Praeg 2011).

Measuring IT services for improvement is a challenging feat that requires both quantitative and qualitative metrics based on diverse service quality measures such as IT service quality, information systems quality, process quality, customer satisfaction, service value and service behaviour (Lepmets et al. 2012). The original study on IT service quality by Lepmets, Ras and Renault (2011) reviewed several standards and frameworks on ITSM and software engineering disciplines: ITIL, ISO/IEC 20000, SERVQUAL, the Practical Software and Systems Measurement (Clark 2001) and Systems and software Quality Requirement and Evaluation (SQuaRE) based on ISO/IEC 25010 (ISO/IEC 2011a). They proposed a quality measurement framework consisting of four common issue areas for IT service measurement: IT service quality, information system quality, process performance and customer satisfaction (Lepmets, Ras & Renault 2011). They extended their IT service quality measurement framework through a systematic literature review to include two more common issue areas: (a) value, as the intrinsic quality of a service design and (b) service behaviour, gathered through employee satisfaction surveys (Lepmets et al. 2012).

The intrinsic measures of process quality from the IT service quality measurement framework by Lepmets et al. (2012) were extensively reviewed to search for methodological guidance provided by the measures to improve IT service quality. Research in this area confirmed the role of process quality to improve IT service quality. ITSM improvement was reported due to adoption of ITIL for better processes (Dumitriu 2008), use of process models for ITSM (Zhao et al. 2009), use of integrated monitoring applications for specific ITIL processes (Paschke & Bichler 2008; Sakurai 2007) and a study by Martin (2003) on the organisational drivers for the improvement of one specific ITSM process: configuration management. However, these studies provided little to no guidance on how process quality is measured even though relevant process metrics were discussed.

2.6.1 Measurement of IT Services based on Process Metrics

In a number of studies, performance of IT service measured using process quality metrics have been discussed for specific ITSM processes. For example:

- Service level management – Gao and Qiu (2010) proposed a dynamic service level management system that maintains service level objectives thereby increasing reliability of service systems. Likewise Sauvé et al. (2005) suggested that the service level agreements should be designed from a business perspective for effective measurement.
- Service delivery – Kumaran et al. (2007) found that new IT service workflow automation tasks can support communication between the provider and customer of IT services leading to better service delivery processes.
- Knowledge management – Chang et al. (2009) concluded that process improvement initiatives should be aligned with the organisation's core values to implement and measure knowledge management processes.
- Incident management – Bartolini, Stefanelli and Tortonesi (2008) proposed a decision support system for performance improvement of incident management process that simulates the effect of corrective measures before their actual implementation, thereby enabling cost, effort and time saving.

These studies demonstrated how performance of IT service can be enhanced based on effective process implementation. However assessment and improvement methods for the ITSM processes being implemented were not discussed in these studies.

Several researchers have also explored measurement of different attributes of process quality such as process performance improvement levels (Al-Hawari, Ward & Newby 2009; Suárez-Barraza, Ramis-Pujol & Llabrés 2009), process compliance (Bhamidipaty et al. 2009; Pauley 2010), process effectiveness and efficiency (Donko & Traljic 2009; McNaughton, Ray & Lewis 2010), process complexity levels (Diao & Bhattacharya 2008; Keller, Brown & Hellerstein 2007), and critical success factors for implementation of processes (Pollard & Cater-Steel 2009) in order to associate such attributes with IT service quality. These studies defined several types of process metrics used in IT service quality. However assessment methods to calculate process metrics have not been discussed in depth.

Few studies provided methodological guidance on the approach to determine process quality measures. Edgeman, Bigio and Ferleman (2005) reported using a self-assessment methodology based on business excellence models and Six Sigma process improvement techniques to improve IT services in a government agency. They also used the ITIL maturity assessments (MacDonald 2010) for several ITIL service delivery processes. However a number of critical flaws in the assessment approach were reported, such as surveys with compound questions that allow only a "yes" or "no" response and the lack of depth in questions and responses leading to weak assessment of maturity (Edgeman, Bigio & Ferleman 2005).

Brenner, Radisic and Schollmeyer (2002) devised a method to analyse ITSM processes according to the characteristics of optimal processes to establish benchmarks for process quality. They demonstrated the use of a generic catalogue for the incident management process of ITIL to evaluate IT service quality. Their research deals with optimisation of ITSM process implementation for quality measurement. However assessment of processes for service improvement is not discussed.

Sharifi et al. (2008) demonstrated the implementation of incident management process through an effective collaboration with Key Performance Indicators (KPIs) to measure and improve the process. Their method generated the most common KPIs and practices for the incident management process based on industry experience. Likewise Hickey and Siegel (2008) reported the use of multiple standards to improve IT service quality through process integration and interfaces. Using ITIL processes and the international standard for process assessment (ISO/IEC 15504), Barafort, Di Renzo and Merlan (2002) provided evidence of repeatable and objective improvement in IT service quality. Extensive work on the combination of ITIL and ISO/IEC 15504 led to the development of an ITSM process assessment method called Tudor IT Process Assessment, or TIPA for ITIL in short (Barafort et al. 2009). Besides academic research, TIPA is also promoted as a commercial framework for ITSM process assessment (Renault & Barafort 2014). Hence, TIPA is the only framework that features in both academic studies (this section) and industry practice (section 2.7) on ITSM process assessment. A total of 32 primary academic studies were directly related to activities surrounding ITSM process assessments. Table 2.5 presents the outcome of the literature review on ITSM process assessment.

Table 2.5 Primary Studies relating to ITSM Process Assessment

Article Reference	ISO/IEC 15504	ISO/IEC 20000	ITIL
How to Design an Innovative Framework for Process Improvement? The TIPA for ITIL Case (Barafort, Rousseau & Dubois 2014)	☑		☑
Assessing Partially Outsourced Processes—Lessons Learned from TIPA Assessments (Cortina, Renault & Picard 2014)	☑		☑
The Evaluation of the IT Service Quality Measurement Framework in Industry (Lepmets et al. 2014)	☑	☑	☑
TIPA Process Assessments: A Means to Improve Business Value of IT Services (Cortina, Renault & Picard 2013)	☑		☑
Towards an Agile Method for ITSM Self-Assessment: A Design Science Research Approach (Göbel, Cronholm & Seigerroth 2013)			
Measuring ITSM: Measuring, Reporting, and Modelling the IT Service Management Metrics that Matter Most to IT Senior Executives (Steinberg 2013)		☑	☑
IT Service Management Process Improvement based on ISO/IEC 15504: A systematic review (Mesquida et al. 2012)	☑	☑	☑
Evaluation on Information Technology Service Management Process with AHP (Wan, Zhang & Wan 2011)	☑		☑
ISO/IEC 15504-5 Best Practices for IT Service Management (Mesquida & Mas 2011)	☑	☑	
Improving the Deployment of IT Service Management Processes: A Case Study (Jäntti & Järvinen 2011)		☑	☑

TIPA: 7 years' experience with SPICE for IT Service Management (Renault & Barafort 2011)	☑		☑
The ITSM Process Design Guide: Developing, Reengineering, and Improving IT Service Management (Knapp 2010)			☑
How to improve Process Models for Better ISO/IEC 15504 Process Assessment (Picard, Renault & Cortina 2010)	☑		
ITIL Maturity Model (Pereira & da Silva 2010)			☑
Process Assessment as a Means to Improve Quality in IT Services (Cortina et al. 2010)	☑		☑
Assessing - Learning - Improving, an Integrated Approach for Self-Assessment and Process Improvement Systems (Malzahn 2009)	☑		
IT Service Departments Struggle to Adopt a Service-Oriented Philosophy (Cater-Steel 2009)	☑	☑	☑
Sustainable Service Innovation Model: A standardized IT Service Management Process Assessment Framework (Barafort & Rousseau 2009)	☑		☑
TIPA to keep ITIL going and going (St-Jean 2009)	☑		☑
ITSM Process Assessment Supporting ITIL (Barafort et al. 2009)	☑		☑
ITIL Assessment in a Healthcare Environment: The Role of IT Governance at Hospital Sao Sebastiao (Lapãoa et al. 2009)			☑
How to evaluate benefits of Tudor's ITSM Process Assessment? (St-Jean & Mention 2009)	☑		☑
A transformation process for building PRMs and PAMs based on a collection of requirements – Example with ISO/IEC 20000 (BarafortRenault, et al. 2008)	☑	☑	
Modelling and Assessment in IT Service Process Improvement (BarafortJezek, et al. 2008)	☑		☑
An industrial Experience in Assessing the Capability of Non-software Processes Using ISO/IEC 15504 (Coletta 2007)	☑		
Assessing IT Service Management Processes with AIDA – Experience Feedback (Hilbert & Renault 2007)	☑		☑
SPICE Assessments for IT Service Management according to ISO/IEC 20000-1 (Nehfort 2007)	☑	☑	
SPICE in retrospect: Developing a standard for process assessment (Rout et al. 2007)	☑		
A service extension for SPICE? (Malzahn 2007)	☑	☑	☑
ITIL based service management measurement and ISO/IEC 15504 process assessment: a win-win opportunity (Barafort et al. 2005)	☑		☑
Process Assessment for Use in Very Small Enterprises: The NOEMI Assessment Methodology (Di Renzo & Feltus 2003)	☑		☑
Benefits Resulting from the Combined Use of ISO/IEC 15504 with the Information Technology Infrastructure Library (ITIL) (Barafort, Di Renzo & Merlan 2002)	☑		☑

As shown in Table 2.5, 26 primary academic studies of the 32 articles (i.e. over 80% studies) used ISO/IEC 15504 for their assessment method. This suggests the popularity of the international standard for the assessment of ITSM processes. Of the remaining six primary studies, two used the Capability Maturity Model Integration (CMMI) model (Göbel, Cronholm & Seigerroth 2013; Steinberg 2013). Likewise one of the studies used the ITIL process maturity framework for ITSM process assessments (Knapp 2010). Another study used the questionnaires from ITIL v2 for assessments (Lapãoa et al. 2009). Jäntti and Järvinen (2011) used a model called KISMET (Keys to IT Service Management Excellence Technique) that was developed from the ITSM research projects at the University of Eastern Finland to assess and improve ITSM processes. Finally one of the studies proposed a new ITIL Maturity Model (Pereira & da Silva 2010) that was used to develop a questionnaire to assess the ITIL incident management process.

Five primary studies specified neither ITIL nor ISO/IEC 20000 as the process reference model to assess ITSM processes. These studies were primarily focused on the discussions relating to the potential use of process assessment concepts in ITSM. One of the studies focused on the development of process models for assessment (Picard, Renault & Cortina 2010). There is one primary study that did not refer to ISO/IEC15504, ISO/IEC 20000 or ITIL but still discussed ITSM process assessment using an agile method based on CMMI for Services (CMMI-SVC) (Göbel, Cronholm & Seigerroth 2013). Furthermore, six studies discussed general ITSM process assessment concepts that covered both ISO/IEC 20000 and ITIL as the process reference model. However most of these studies explored overall IT service quality factors, rather than a specific focus on ITSM process assessment methods.

There were 17 primary studies that discussed ITIL as the process reference model for ITSM process assessments and only three primary studies were found to have explicitly used ISO/IEC 20000. Moreover, 12 of the 17 studies that used ITIL as the process reference model are based on TIPA for ITIL (Barafort et al. 2009). This illustrates the dominance of the TIPA framework in academic research on ITSM process assessment. The remaining five studies used different methods to assess ITSM processes such as evaluation methods based on the Analytical Hierarchy Process (Wan, Zhang & Wan 2011), ITIL Process Maturity Framework (Knapp 2010), questionnaire based on ITILv2 from the Office of Government Commerce (OGC) (Lapãoa et al. 2009), the NEOMI assessment methodology for use in small enterprises (Di Renzo & Feltus 2003) and a newly proposed ITIL maturity model (Pereira & da Silva 2010).

Coletta (2007), Malzahn (2009) and Rout et al. (2007) reported the potential of the ISO/IEC 15504 standard beyond its original software engineering field. Malzahn (2009, p. 7) advocated that the software engineering standard SPICE on which ISO/IEC 15504 is based can be the “silver bullet as a centre of several extensions, if the extending standards can be structured in processes”. Hilbert and Renault (2007) said that a standard approach provides the objectivity required to measure process improvements effectively. The lessons learnt from their research about using the credibility of international standards are relevant to this research.

Cater-Steel (2009) reported the struggle of IT service organisations to embark on CSI even after successfully adopting ITIL and called for redesign of processes. She suggested process improvement must be prioritised before the selection of tools for IT service delivery. Likewise, BarafortJezek, et al. (2008) presented the role of process models in process assessment leading to ITSM process improvements. Mesquida et al. (2012) executed a systematic literature review on ITSM process improvement based on ISO/IEC 15504 and found 28 relevant primary studies. One is linked to ISO/IEC

20000 (Nehfort 2007), whereas ten studies relate to the use of ITIL and ISO/IEC 15504.

Barafort et al. (2005) and Kramer (2008) explored the potential benefits of using the ITIL framework and ISO/IEC 15504 for consistent ITSM process assessment. This led to the publication of a prescriptive book that presented an overall method to conduct process assessment based on ITIL and ISO/IEC 15504 using their TIPA methodology (Barafort et al. 2009). TIPA provides valuable information to conduct objective ITSM process assessments. However TIPA uses the ITIL framework and is not synchronised with the ISO/IEC 20000 standard.

TIPA has gained support for continually improving ITSM processes based on ITIL (Barafort, Rousseau & Dubois 2014; St-Jean 2009). St-Jean and Mention (2009) presented an approach of evaluating TIPA benefits to reduce assessment costs. Renault and Barafort (2011) and Cortina, Renault and Picard (2013) have also provided evidence that their experience with TIPA has been successful. Furthermore, TIPA has been extended to present a sustainable service innovation framework in ITSM (Barafort & Rousseau 2009). This suggests that the combination of ITIL and ISO/IEC 15504 has been well researched in comparison with the combination of ISO/IEC 15504 and ISO/IEC 20000. This research will use the under-researched latter combination. Moreover, ISO and IEC published a process assessment model to demonstrate an exemplar ITSM process assessment approach in 2012 (ISO/IEC 2012b). The standard process assessment model is used to develop the SMPA approach in this research.

It can be concluded that the existing IT service quality research has primarily focused on measurement issues related to customer service perception (primarily using the SERVQUAL instrument). Lepmets et al. (2014) recognised the need to explore other intrinsic measures of IT service quality while developing and evaluating a quality measurement framework for IT services. Based on a systematic literature review, process performance measures in terms of compliance, efficiency and effectiveness of the IT service processes were defined (Lepmets et al. 2012). However it appears that very limited academic research has investigated the “method” to conduct process assessments for IT service quality. The literature review identified that with a notable exception of TIPA for ITIL (Barafort et al. 2009), there is little empirical evidence specifically about the method of ITSM process assessments. The aim of this research is to address this research gap by conducting a thorough investigation of ITSM process assessments to conduct assessments in a transparent and efficient manner. Existing approaches of ITSM process assessment in practice are discussed next.

2.7 Existing Industry Practice on ITSM Process Assessment

This section reviews the existing methods in ITSM process assessments in order to articulate the research problem of the lack of transparency and the need for efficiency. ITIL defines three types of metrics for service improvements: service, technology and process metrics (Lloyd 2011). The existing literature of IT service quality in terms of the SERVQUAL model provided a rich discussion of service metrics as presented in *section 2.6*. Technology metrics, such as mean time between incidents, are directly accessible when an integrated ITSM tool is implemented. A review of the process metrics to measure and evaluate how activities are being performed in ITSM process assessment is presented next.

ITSM process assessment methods are discussed as best practice guidelines in the IT industry. Many of the solutions offered for ITSM process assessment are commercially available and aimed at selling organisations either a self-assessment toolkit or providing consultancy services as part of improvement initiatives, for example, self-assessment service based on ITIL Maturity Model (AXELOS 2014) or online maturity assessments by PinkElephant (2014). These bespoke ITSM assessment services provide assessment results from proprietary perspectives. These services can be considered as a black box since the rationale behind the assessment activities is not fully disclosed and therefore they do not contribute directly to the scientific community regardless of their commercial value. Table 2.6 lists eight existing ITSM process assessment methods used in practice.

Table 2.6 Existing ITSM Process Assessment Methods in Practice

ITSM process assessment method	**Process Reference Model**	**Measurement framework**	**Seminal Publication**
Tudor IT Process Assessment (TIPA) for ITIL	ITIL (individual processes)	ISO/IEC 15504-2	ITSM Process Assessment Supporting ITIL (Barafort et al. 2009)
Standard CMMI Appraisal Method for Process Improvement (SCAMPI) for CMMI for Services (CMMI-SVC)	CMMI-SVC (process areas)	CMMI	CMMI-SVC (CMMI 2010) SCAMPI Method Definition Document & Appraisal Handbook (CMMI 2011)
Pink SCAN	ITIL (individual processes)	CMM-based (proprietary)	PinkSCAN – Online Process Maturity Assessment (PinkElephant 2014)
ITIL Process Assessment Framework	ITIL (organisational maturity based on several processes)	Service Management Process Maturity Framework	ITIL Process Assessment Framework (MacDonald 2010)
ITIL Maturity Model and Self-assessment service	ITIL (26 individual processes and four functions)	ITIL Maturity Model (aligned with COBIT & CMMI)	ITIL Maturity Model (AXELOS 2014)
SPICE 1-2-1 for ISO20000	ISO/IEC 20000 (individual processes)	ISO/IEC 15504-2	SPICE Assessments for IT Service Management according to ISO/IEC 20000–1 (Nehfort 2007)
TickITplus Scheme	IT processes defined as a model for a particular scope (e.g. software development and data security)	ISO/IEC 15504-2	Delivering Quality in IT: The TickITplus scheme (Irving 2010)
IT Service CMM	Service CMM process areas	Software CMM-based	IT Service CMM (Clerc & Niessink 2004)

Four of the eight ITSM process assessment methods are based on academic research: TIPA for ITIL (Barafort et al. 2009); SPICE 1-2-1 (Nehfort 2007); SCAMPI using CMMI-SVC (CMMI 2011) and IT service CMM (Clerc & Niessink 2004).

Other approaches emerged from industry best practices, particularly from ITIL (AXELOS 2014; MacDonald 2010). The measurement frameworks of all eight ITSM process assessment methods are based on one of two models: CMM/ CMMI and ISO/IEC 15504. ITIL is the most used process reference model for ITSM process assessment. ISO/IEC 20000 is used in one of the ITSM process assessment methods (Nehfort 2007). Non-ITIL approaches such as CMMI for Services (CMMI 2010) or eSCM for service providers (Hyder, Heston & Paulk 2004) have transparent models and methods as well. The eight ITSM process assessment methods are reviewed next.

2.7.1 Tudor IT Process Assessment (TIPA) for ITIL

Tudor IT Process Assessment (TIPA) is a process assessment framework developed by the Public Research Centre Henri Tudor based in Luxembourg (Tudor 2014). TIPA is an open framework for the assessment of IT processes defined initially in 2003 as the AIDA (Assessment and Improvement integrateD Approach) research and development project (Hilbert & Renault 2007). The objective of TIPA is to develop a common method for the definition and assessment of processes in any domain based on the measurement framework of ISO/IEC 15504-2.

The TIPA framework combines domain-specific process models with the generic TIPA process assessment method. The ISO/IEC 15504-2 requirements to perform assessments are structured and documented in the TIPA assessment framework. Moreover, the TIPA framework is supported by a library of templates and tools for every step of the assessment process that can be customised to any domain (Tudor 2014).

TIPA for ITIL is the application of the TIPA framework to the ITSM domain. It applies the TIPA assessment method to the ITSM best practices described in ITIL 2011. The TIPA framework has extended the set of requirements from ISO/IEC 15504 to provide a detailed and documented assessment process for ITIL processes (TIPA 2014). TIPA for ITIL can be considered as the most relevant and academically sound ITSM process assessment framework available. Therefore the TIPA framework is discussed in this section as one of the industry practices and also in the previous section (section 2.6) since a large number of academic studies relate to the TIPA framework.

2.7.2 Standard CMMI Appraisal Method for Process Improvement (SCAMPI)

The Capability Maturity Model (CMM) was initially developed in 1986 by the Software Engineering Institute (SEI) at Carnegie Mellon University. The CMM defined a five-level model for process maturity: Initial; Repeatable; Defined; Managed; and Optimized. Based on the CMM model, the CMM Integration (CMMI) model was developed and first introduced in 2001. One of the important changes in the CMMI model from the CMM model is the introduction of continuous representation which enables the option of assessing and grading each process individually with a process capability level (CMMI 2011). Furthermore, the concept of continuous representation which is a central concept in the ISO/IEC 15504 standard as well, allows CMMI to be ISO/IEC 15504 compatible, a feature important for the international community (Rout & Tuffley 2007).

In the continuous representation, each process area is handled on its own in terms of a process capability level which ranges from 0 to 5 (Yucalar & Erdogan 2009). The continuous representation allows the measurement of improvement at the process level and hence enables better monitoring of process improvement by upper management (Yoo et al. 2004). There are three classes of CMMI appraisal: A, B, and C based on their costs and resource requirements (Ekdahl & Larsson 2006). Class C appraisals have the lowest cost and are easiest to perform, and can be undertaken by an online assessment survey.

CMMI for Services (CMMI-SVC) is a CMMI model developed by SEI and released in March 2009 to describe processes for managing and delivering services. This model is based on other service-focused models such as ITIL, ISO/IEC 20000, COBIT and IT Service CMM (CMMI 2010). The CMMI-SVC model focuses on the activities of the service provider providing guidance to develop and improve service practices (Forrester, Buteau & Shrum 2011). CMMI-SVC is a detailed model to follow, however organisations already using CMMI in a software and development context may use CMMI-SVC for service management processes (Barafort et al. 2009).

Standard CMMI Appraisal Method for Process Improvement, or SCAMPI in short, is a method that details how to provide benchmark quality ratings relative to CMMI models (CMMI 2011). Therefore, SCAMPI can use the CMMI-SVC model as the process reference model in order to conduct ITSM process assessments. The use of this combination resulting in process improvement in a service organisation has been reported (Herndon et al. 2003).

2.7.3 PinkSCAN

Pink Elephant, a leading global ITSM consulting company based in Canada, has developed a method for ITSM process assessment called PinkSCAN in 1994. PinkSCAN uses an online assessment tool with 600 assessment questions to determine maturity level of ITIL processes (PinkElephant 2014).

Pink Elephant has a proprietary process assessment and improvement methodology based on CMM, however little public information is available since it is a commercial service available through consultancy. It is reported that this approach is not flexible and does not provide a useful input for the improvement of the processes (Barafort et al. 2009).

2.7.4 ITIL Process Assessment Framework

The ITIL Process Assessment Framework is based on CMM principles and uses a service management Process Maturity Framework (PMF) to assess ITIL processes according to the five levels of maturity: Initial; Repeatable; Defined; Managed; and Optimised (MacDonald 2010). However, the scope of the ITIL Process Assessment Framework is broader than just processes. Using this framework, process maturity is determined in terms of five dimensions: vision and steering; people; processes; technology; and culture. This framework assesses an IT service provider’s compliance with the ITIL guidelines using the five dimensions from the IT organisational growth model to measure process and non-process capabilities (Hunnebeck 2011).

2.7.5 ITIL Maturity Model and Self-assessment service

AXELOS is the company that currently holds the rights to manage and develop the ITIL framework. AXELOS has released the ITIL Maturity Model (AXELOS 2014) that contains a set of 30 questionnaires – one questionnaire for each of the 26 ITIL processes and four ITIL functions. The questionnaire includes questions relating to process demographics, generic and specific attributes, inputs, outputs, outcomes and interfaces (AXELOS 2014). All questions have two possible responses – ‘Yes’ or ‘No’ and correspond to the five levels of ITIL PMF (Hunnebeck 2011).

A high-level self-assessment as a free subscription service is provided by AXELOS. This service features a reduced set of questions for each process and aims to provide an overall indication of an organisation’s process maturity. Likewise, a full self-assessment service is also offered by AXELOS. The full service is a paid-for subscription service that contains the full set of 4,000 questions across the 30 questionnaires. This service can be used to fully assess ITIL process capability and to track process maturity progress and plans for improvement (Rudd & Sansbury 2013).

2.7.6 SPICE1 1-2-1 for ISO20000

SPICE 1-2-1 for ISO20000 is an ITSM process assessment method that is focused on improvement of processes listed in ISO/IEC 20000. This method is promoted to be useful to conduct two of the four step approach called “Assessment-based Process Improvement” proposed by HM&S IT-Consulting group (HM&S 2014b). The four steps are (1) initial assessment; (2) selection and planning for process improvement; (3) process improvement; and (4) evaluation assessment. Steps 1 and 4 of the approach can be supported by an assessment tool that uses the SPICE 1-2-1 for ISO20000 method (HM&S 2014b). This method is based on ISO/IEC 15504-2 and uses the ISO/IEC 20000 process reference model (ISO/IEC 2010), however a proprietary process assessment model is developed and implemented as a software tool for assessors to use during data collection for process assessment (Nehfort 2007).

2.7.7 TickIT Plus Scheme

The TickITplus scheme offers a flexible approach to IT quality and certification assessment. It was launched in 2011 by the British Standards Institution (BSI) group’s Joint TickIT Industry Steering Committee (TickITplus 2014). The scheme introduced capability assessment concepts to adopt a fully process-driven approach to business systems management including ITSM.

The TickIT Plus Scheme is built around the ISO/IEC 15504 standard for five levels of certified assessments: Foundation; Bronze; Silver; Gold and Platinum (Irving 2010). The foundation level requires a process model to be defined and verified however no direct process assessment activity is required (Irving 2008). The four upper levels correspond to the capability levels 2-5 of the ISO/IEC 15504 measurement framework (ISO/IEC 2004b). One of the benefits of the TickIT Plus scheme is flexibility, whereby formal ITSM process assessments can be undertaken in discrete stages for self-assessment or external certification. The TickIT Plus scheme has added ISO/IEC 20000 as a standard process model in its structure to conduct ITSM process assessments (TickITplus 2014).

2.7.8 IT Service CMM

Sponsored by the Dutch Ministry of Economic Affairs and released in January 2005, IT service CMM is a maturity model based on the software CMM v1.1. IT service CMM contains a number of process areas needed to improve IT services (Clerc & Niessink 2004). The model allocates several process areas to separate process categories at each maturity level. The objective of IT service CMM is to measure and improve IT service process maturity (Clerc & Niessink 2004). The model does not specify a technique for assessment. Due to the alignment of this model with CMMI, the CMMI appraisal methodology (SCAMPI) may be used to perform assessment. The IT service CMM model focuses on maturity of organisations that provide IT services. The use of IT service CMM in a university service delivery environment reported the effectiveness of the model in ITSM process assessment (Wachob & McCord 2005). However, more recent use of the model has not been reported and therefore the model may not be widely used at present.

2.7.9 Other Methods of ITSM Process Assessment

A few other methods of ITSM process assessment were found but they do not extensively discuss the activities involved in process assessment. A brief overview follows.

2.7.9.1 Software Process Improvement Initiative (SPINI+)

SPINI+ defines an ITSM process library based on ITIL and ISO/IEC 20000 (Mesquida et al. 2012). The SPINI+ framework combines process modelling and process assessment methods for a process library based on the indicators of the assessment model that is compliant with ISO/IEC 15504 (BarafortJezek, et al. 2008). It has been reported that the process library was extended with ITSM processes (Varkoi & Makinen 2008). No further information about the development of the framework was found during the literature review.

2.7.9.2 NOVE-IT Capability dEtermination (NiCE)

NOVE-IT is a process model developed from a project by the Swiss federal government to establish and assess processes covering IT procurement, development, operation, and service provision (Cass et al. 2002). Using the NOVE-IT model, an assessment model based on ISO/IEC 15504-2 was developed and referred to as NOVE-IT Capability dEtermination (NiCE) framework. No further development of the NiCE framework has been reported in the literature.

2.7.9.3 NEOMI - Nouvelle Organisation de l'Exploitation et de la Maintenance Informatiques

NEOMI is an IT process assessment methodology designed to be used particularly in very small enterprises (VSEs). The process portfolio aims at a whole coverage of the usual IT-practices in VSEs (Di Renzo & Feltus 2003). It is a business value-driven method and designed in five process areas: infrastructure; service support; management; security; and documentation. The processes themselves are based on a combined approach of ISO/IEC 15504 and ITIL (Di Renzo, Feltus & Prime 2004). This approach assesses processes at Level 0 (incomplete) and Level 1 (Performed) only.

2.7.9.4 CITIL

CITIL was developed in 2007 by the *Technical University Darmstadt* and *wibas IT Maturity Services GmbH* with the consent of SEI and TSO (Barafort et al. 2009). As the name suggests it is a combination of CMMI and ITIL models in a single framework to support improvement of both development and operations of IT products and services. CITIL was originally based on ITILv2 and CMMI for development v1.2 however there is no effective integration of ITIL processes within the existing CMMI model (Barafort et al. 2009). No specific assessment technique is specified in CITIL.

2.7.9.5 OGC Self-Assessment Tool

The Office of Government Commerce (OGC) self-assessment tool used a process management framework consisting of nine process elements against which the questions and subsequent reports were aligned (MacDonald 2010). Based on ITIL v2, this self-assessment method was a free online tool developed by the OGC and subsequently endorsed by the itSMF group. It was available on the itSMF website via the link: www.itsmf.org/tools/sa.asp. It asked a series of questions to evaluate ITIL compliance of the ITSM processes. However the tool is no longer available online for assessment.

Besides the published methods, a number of other proprietary methods have been proposed in the IT industry. Technology giants such as HP, IBM and Microsoft have proposed their ITSM assessment methods that are related to their specific technology and services among other things. A list of technology specific proprietary frameworks is provided in Table 2.7.

Table 2.7 Technology-Specific ITSM Process Assessment Frameworks

Company	**ITSM Assessment Method**	**Description**
Hewlett Packard (HP)	HP Service Management Reference Model (HP 2014)	HP's vision on how to improve ITSM processes is described and explained in the model. The model is based on ITIL and uses a catalogue of template solutions based on the best practice expertise from HP. The template solutions are available for purchase from HP.
IBM	IBM Process Reference Model for IT (IBM 2008)	The IBM Process Reference Model for IT is a tool to investigate and identify areas of improvement for IT management. The model comprises eight process categories and a list of processes aligned with ITIL to design and deliver IT services.
Microsoft	Microsoft Operations Framework (MOF) (Microsoft 2009)	Currently in version 4.0, MOF provides practical guidance to implement reliable and cost-effective IT services based on Microsoft Solutions Framework (MSF) best practices.

In summary, a number of proprietary methods available in current practice provide methodological guidelines for ITSM process assessments. Some of the approaches such as PinkSCAN and technology models such as HP service management model, IBM process reference model and MOF provide prescriptive guidelines for ITSM process assessments specific to their technologies and services. The generic approaches are based on the CMMI or ISO/IEC 15504 standard; however they provide their own process assessment model. A lack of transparency and efficiency is evident in the existing ITSM process assessment methods which justified the research problem introduced in Chapter 1. The next section presents the development of the research problem based on the literature gap.

2.8 Development of the Research Problem

The research problem that this research is motivated to solve has already been stated in Chapter 1. Addressing transparency and efficiency are two major challenges of process assessments (Lloyd 2011). These challenges are taken into account as important problems that must be solved by the proposed SMPA approach. Based on the academic literature review and existing industry practices on ITSM process assessments, the two key problems of the lack of transparency and the need for efficiency in ITSM process assessments are justified next.

2.8.1 Lack of Transparency

For the task of process assessment, transparency is the degree of information availability and visibility during the assessment activities. With the notable exception of TIPA for ITIL (TIPA 2014), there is a lack of detailed research on ITSM process assessments in the literature. The existing ITSM process assessment methods advocate their measurement framework for transparent process assessment. All the process assessment methods discussed in the literature and the proprietary process assessment services offered by consultants in the IT industry appear to be based on one of the two related measurement frameworks: CMMI and ISO/IEC 15504. Both measurement frameworks for process capability determination originated from the software engineering discipline and are largely harmonised in their measures (Rout & Tuffley 2007). Moreover, the role of ISO/IEC 15504 as a consistent measurement framework for ITSM process assessment was confirmed by a systematic literature review (Mesquida et al. 2012). However most of the studies proposed their own proprietary assessment models to conduct ITSM process assessments. None of the existing approaches have used the publicly available and transparent process assessment model for ITSM defined by ISO/IEC 15504, i.e. ISO/IEC 15504-8 which was released in 2012.

Transparency can be demonstrated by aligning the assessment activities with the ISO/IEC 15504 standard that provides guidance on conducting the assessment process (Cortina, Renault & Picard 2014). Clause 4.1 in ISO/IEC 15504-2 provides general requirements to perform an assessment. Moreover, there are process assessment tools, particularly in the software engineering discipline, that are 100 percent compliant with the normative and informative parts of the ISO/IEC 15504 standard such as SPICE-Lite Assessment tool (HM&S 2014a), SEAL software assessment tool (Walker & Lok 1995), SPICE 1-2-1 tools (Nehfort 2007) and Appraisal Assistant (Liang 2007). These assessment tools provide an interface to the assessors to record evidence for standard indicators, rate process capabilities and produce assessment reports. These assessments are transparent in the sense that they align with the standard.

However, there is still lack of transparency in the assessment method particularly in terms of how data collection, analysis and presentation is conducted. Commercial software tools for ITSM process assessments offered in the ITSM industry (e.g. PinkElephant 2014) also report alignment with the standard frameworks (ISO/IEC 15504, ITIL, CMMI) but provide little explanation regarding the assessment model and method used. ITSM assessment results depend on the subjective judgment of assessors (Bernard 2012). Lloyd (2011, p. 77) suggested that even though assessments tend to be objective in terms of measurement and assessment factors, the assessment results are "still subject to the opinion of assessors". Therefore assessment outcomes can have a bias according to the "attitudes, experience and approach" undertaken by the assessment team in a subjective manner (Lloyd 2011, p. 77).

In summary, the existing ITSM process assessment methods have challenges in regards to transparency because they predominantly use interviews which are subject to interpretation by both the participant and the assessor. Moreover, the interview questions are used to map participant opinions to the standard indicators based on a proprietary assessment model. Furthermore, assessment results are based on the subjective evaluation of the assessors for process capability determination and process improvement recommendations. The issue of transparency is therefore a significant hurdle to conduct an objective process assessment that can be consistently repeated. Transparency is therefore considered as a critical task challenge that needs to be addressed by the proposed SMPA approach.

2.8.1.1 Theoretical Justification: Agency Theory

A grand theory from the discipline of economics, Agency Theory (Eisenhardt 1989a) may be applied to provide theoretical support to understand how the SMPA approach can improve transparency in ITSM process assessments. Agency theory explains that a major problem in agency relationships is to ensure that an agent acts in the interests of the principal (Eisenhardt 1989a). In the context of this research, an IT service provider (external or internal) represents the agent providing IT services to an organisation, which can be represented as the principal. Bounded rationality of the principal prohibits a transparent assessment of what the agent is doing. Self-interest of the agent may create misalignment of their activities with business goals of the principal organisation. In such circumstances, agency problems such as goal conflict and information asymmetry arise. Information asymmetry exists between the organisation and their IT service providers in regards to the business value and capability of the ITSM processes. The use of the international standards in the SMPA approach can promote transparency while conducting ITSM process assessments.

Since IT service delivery is organised around processes, ITSM process assessments can provide transparent information from an independent view of a third party authority, i.e. international standards in this case, that can assist to reduce information asymmetry. The SMPA approach provides a set of technological rules to conduct a standards-based process assessment of ITSM processes, thus reducing agency problems in the relationship between IT service providers and organisations that procure IT services.

2.8.2 Need for Efficiency

Efficiency measures resources expended in relation to the accuracy and completeness with which users achieve goals (ISO 1998). For the task of ITSM process assessments, relevant resources include time to complete the task (human resources), materials, and the financial cost of usage. Efficiency determines the degree of economy with which any assessment consumes resources (Roberts 1994). These efficiency metrics are not appropriate to be measured in monetary value. This is because process assessment costs are represented not only by consulting fees that are expensive particularly for small organisations, and also by the use of labour-intensive resources as well as risks of non-acceptance of assessment results (Lloyd 2011). Such costs have led some researchers to conclude that process assessments are wasteful (Fayad & Laitinen 1997). Moreover, Bernard (2012) warns that process assessments do not give insight into the cultural dynamics of an organisation and can be a goal rather than a means to an end due to their labour-intensive and costly activities.

None of the ITSM assessment approaches except two commercial offerings, PinkElephant (2014) and ITIL self-assessment service (AXELOS 2014), use online surveys to collect assessment data directly from process stakeholders. Using online surveys to collect responses directly from process stakeholders saves precious time for assessment data collection and gives an opportunity to easily calculate process capability scores based on the responses. Previous research does not seem to experiment with this option even though assessment tools have been developed for competent assessors to input their evidence from interviews and document reviews. Moreover, published research on the development of a method to conduct online survey-based ITSM process assessment is scant even though there are several industry initiatives towards this. Furthermore, there are industry reports of high costs and resource constraints discouraging ITSM process assessments even though organisations see value in the idea of assessments (Mainville 2014). Hence this problem is relevant in the IT industry.

2.8.2.1 Decision Support System

Efficiency can be achieved in process assessments since a number of process assessment activities can be automated with the use of a Decision Support System (DSS). Use of a DSS can also eliminate the need for subjective judgment to determine process capability levels and provide process improvement recommendations. Although traditionally associated with strategic decision-making for managers (Alter 1980), in the current perspectives DSS is a general term for any computer information systems that support decision-making activities of individuals and groups (Power, Burstein & Sharda 2011). Beyond the “data focus” in the electronic data processing (EDP) systems or “information focus” in the management information systems (MIS), a DSS has a “decision focus” thus representing a more mature form of information systems to assist users (Sprague 1980).

Five specific DSS types are proposed in the literature: (a) communications-driven DSS; (b) data-driven DSS; (c) document-driven DSS; (d) knowledge-driven DSS; and (e) model-driven DSS (Power 2002). The DSS in the SMPA approach is a knowledge-driven DSS, or “suggestion DSS” as defined by Alter (1980). Knowledge-driven DSS suggest or recommend actions to managers. They use technological rules and knowledge bases in which “knowledge” is stored in the form of rules. Knowledge-driven DSS use an inference engine to process rules or identify relationships in data. Hence, a knowledge-driven DSS requires specialised database components. The DSS platform provided by the research partner in this study meets all these requirements for a knowledge-driven DSS.

Moreover, DSS enables specialised problem-solving based on the knowledge about a particular domain (Power, Burstein & Sharda 2011). The DSS in the SMPA approach stores knowledge items of process improvements based on the ITIL framework. The technological rules relate to the process assessment activities in the SMPA approach. The DSS enables understanding of problems since low process capability scores represent process risks. Using the DSS, process managers get help in decision-making to solve the problems and commence process improvement initiatives.

Only one approach (Nehfort 2007) reported the use of a software tool to conduct ITSM process assessments while only a handful of other tools were discussed in the literature. However, the software tools were designed to be used by the assessor in rating process attributes. While a software tool used in this case could minimise paper handling and manual work, it did not significantly impact the entire method of ITSM process assessment. In other words, the existing assessment tools may qualify as communications-driven, data-driven or document-driven DSS; however they cannot be classified as knowledge-driven DSS due to the lack of technological rules and knowledge base to recommend actions to process managers.

There are several potential drawbacks of employing a DSS approach for assessment, such as high costs, information overload, potential cognitive bias, and likely transfer of decision authority from an expert assessment team to DSS. However, in the SMPA approach, the use of a DSS can automate (a) assessment data collection using online surveys, (b) data analysis to calculate process capability scores, and (c) reporting from a context-based knowledge base of process improvement recommendation items. These opportunities translate to significant cost savings avoiding the use of costly assessors and consultants while enabling self-assessments for IT organisations with fast turnaround time. Repeatable process assessments are a requirement to evaluate CSI (Lloyd 2011). The challenges of efficiency become more prominent when ITSM process assessments are to be repeated for measurement of process and service improvement. Efficiency is therefore the second task challenge to consider while developing the proposed SMPA approach.

2.8.2.2 Theoretical Justification: Transaction Cost Economics Theory

Transaction Cost Economics (Williamson 1981) can be referenced for theoretical support to justify the development of a DSS for the SMPA approach in order to promote efficiency in ITSM process assessments. Transaction Cost Theory is centred on suggesting efficient structures of economic governance by reducing transaction costs (Williamson 1981). According to Williamson (1981), a transaction cost occurs when a service is transferred across a technologically separable interface. Process assessment is not specifically an improvement activity in itself but a crucial requirement for improvement hence a transaction cost for improvement. Therefore, transaction costs arise when the service of ITSM process assessments can be undertaken more efficiently in-house rather than external assessments by outside ITSM vendors and consultants. This is possible since a transparent and standards-based assessment of ITSM processes can be undertaken based on a new set of technological capabilities proposed by the SMPA approach.

The SMPA approach is operationalised as a DSS prototype tool in this research. ITSM process assessments represent a substantial transaction cost (Lloyd 2011). This research proposes that the DSS can demonstrate a more efficient approach to conduct ITSM process assessments. Since transaction cost theory views institutions and markets as two different forms of organising and coordinating economic transactions (Williamson 1973), the more efficient choice is for the organisation to conduct ITSM process assessments itself when the external transaction costs are higher than the organisation's internal costs of undertaking self-assessments. Based on the theory's proposition, the DSS in the SMPA approach can reduce transaction costs by conducting assessments internally with minimal resource requirements since the DSS can automate several process assessment activities and expedite ITSM process assessments. In summary, the proposed DSS in the SMPA approach can potentially reduce transaction costs to conduct ITSM process assessments more efficiently.

Based on the academic literature and industry reports on the lack of transparency and the need for efficiency in ITSM process assessments, the research problem is justified. Several initiatives reported the use of software tools in ITSM process assessments that are either proprietary and commercial in nature (hence not transparent and efficient) or developed only for the assessors to use (hence do not promote efficient self-assessments by IT organisations). Apparently none of the existing process assessment methods discuss or demonstrate the use of a DSS for self-assessment of ITSM processes according to the international standards for ITSM and process assessment.

2.9 Research Opportunities in ITSM Process Assessments

Based on the justified research problem in *section 2.8*, a research gap that suggests the lack of transparency and the need for efficiency in ITSM process assessments is identified. To address the research gap, a method to conduct ITSM process assessments with standards-based models facilitated by a DSS is a novel research opportunity that is explored in this research. Two research opportunities are discussed next in response to the research problem.

2.9.1 Opportunity 1. Structured Method to Select Critical Processes

Several methods in ITSM process assessment activities provide some references to process selection with a discussion on how the processes should be selected for assessment. In the TIPA framework, process selection criteria and factors for choice of processes are briefly specified; however there is no method prescribed for process selection. Earlier research on TIPA suggested conducting pre-assessments with the aid of the Porter and Millar’s Value Chain model (1985) to identify the critical core processes that support business objectives (Barafort, Di Renzo & Merlan 2002). However, the research on TIPA focused on the process assessment and does not explain why and how a process selection method is applied before assessment.

Likewise, the SCAMPI method extensively discusses a method to determine scope in terms of the organisation and its associated sampling factors (CMMI 2011). However, there is no guidance for the selection of process areas for appraisal. Similarly, the ITIL maturity model (AXELOS 2014) and the ITIL process maturity framework (Hunnebeck 2011) have been proposed to assess the capability of ITSM processes. In these approaches, there is no mention of how processes are selected for improvement. Other IT service process improvement methods such as IT Service CMM (Clerc & Niessink 2004), SPICE1-2-1 for ISO20000 (Nehfort 2007) and TickITPlus Scheme (Irving 2010) have defined process areas and acknowledged that process areas need to be grouped and prioritised for improvement but do not put forward any guidelines to do so.

The existing studies support the notion that process selection is a crucial step in process improvement and several of them also suggested factors that associate processes with business goals. Ensuring that the business drivers for process assessment were clearly discussed and agreed upon between all participants upfront is an important requirement to plan for assessments since this reduces resistance to the assessment project (Hilbert & Renault 2007).

In search for a more explicit method for process selection, the literature beyond ITSM was reviewed to find general guidelines to select critical processes in other domains. Several prominent process selection methods were found in the literature. Huxley (2003) developed a ten-step business process improvement targeting methodology that can be applied to select critical processes to improve. The proposed methodology used ranking of five factors: impact; failure probability; dependency; success probability; and cost/benefit for application service providers to prioritise processes (Huxley 2003). The US-Navy (1996) developed a handbook for basic process improvement that included a process selection worksheet providing some practical advice to select processes to improve. Hammer and Champy (2009) presented three ideal attributes of processes to be considered for improvement in business process reengineering projects based on the current process status, its customer impact and improvement feasibility.

Likewise, Davenport and Short (1990) suggested to select processes that are most in conflict with the business vision but require a minimum of time and effort to improve. In a separate research on process innovation and radical change, Davenport (1993) proposed four criteria based on the business climate and project scope for process improvement to guide process selection for innovation. Zellner, Leist and Johannsen (2010) suggested that critical processes should be compared with the critical success factors of an organisation in order to prioritise the processes with the help of the Quality Function Deployment method (Akao 2004). Likewise, Meade and Rogers (2001) provided a general process selection methodology that considers process performance against business vision to select critical processes.

The existing studies proposed several guidelines for process selection however decisions regarding which processes to choose for improvement have generally been complex with little structure in the decision-making process (Meade & Rogers 2001). Multiple criteria for decision-making in regards to process selection have not been found to be properly structured. Moreover, none of the existing studies have reported any development or use of a DSS that enables multi-criteria decision-making to implement a structured method to select processes for improvement. One process selection method (Davenport 1993, p. 32) suggested that even while the process selection method is structured, in practice, “results are often ambiguous, and differential weighting of the factors must be applied”. In situations that require making a selection, using some kind of measurement and thus choosing the process with high scores is a viable option.

While some methods linked business objectives to justify relevant process selection, none of the above studies explicitly incorporated service perceptions of key stakeholders to understand process improvement priorities. Since ITSM has a strong customer-oriented focus, it is risky to ignore how service beneficiaries and other process stakeholders feel about the processes that need improvement. A more balanced method to select ITSM processes should therefore consider service gap perceptions along with business drivers for process improvement. The literature review presented an opportunity to define a structured method to select critical processes for assessment and improvement.

2.9.2 Opportunity 2. DSS for Assessment Data Collection, Analysis and Reporting

Assessment of any process-based management system is feasible using the ISO/IEC 15504 standard (Coletta 2007; Malzahn 2009; Rout 2014). A specific technique to build process models using ISO/IEC 15504 and the international standard for ITSM, ISO/IEC 20000 has been proposed by BarafortRenault, et al. (2008). This study discussed methods to develop process models for assessment but it did not propose any method to conduct ITSM process assessment. Nehfort (2007, p. 1) suggested: "ISO/IEC 15504 can be used as a universal model for process assessment and process improvement". Nehfort's paper described the development of a software tool based on the proprietary models that could be used for assessments. The software tool was targeted to be used by assessors for assessment data collection and analysis.

Part 1 of the ISO/IEC 20000 standard aims to support conformity assessment of the standard requirements in order to enable IT service providers to be certified based on a list of requirements that needs to be fulfilled (ISO/IEC 2011b). This is valuable for a transparent method of an ITSM standard compliance audit. However no specific assessment method is described in the standard, making it ambiguous to identify activities required to be done in order to check and maintain ISO/IEC 20000 compliance.

In order to address this challenge, ISO/IEC 15504 evolved as a generic process assessment standard. Part 4 of the ISO/IEC 20000 standard was released as a technical report in 2010 with the process reference model (ISO/IEC 2010) and ISO/IEC 15504 Part 8 was released as the process assessment model for ITSM (ISO/IEC 2012b). It is expected that the international standards from the same bodies, i.e. ISO and IEC, would encourage a transparent method in ITSM process assessment since having a common standard to manage ITSM enables better IT services (Kumbakara 2008). This combination has the potential to emerge as a transparent ITSM process assessment approach (Barafort et al. 2009).

The use of ISO/ IEC 15504 Part 8 and ISO/IEC 20000 Part 4 as the process assessment model and process reference model respectively has not been studied previously. The choice of the ISO/IEC 20000 and ISO/IEC 15504 is reinforced in this research in recognition of the credibility of the international standards. This research uses the process assessment model from the ISO/IEC 15504 standard to develop the research artefact in order to advocate transparency. The role of international standards has been firmly established in greater adoption of ITSM process assessment (Hilbert & Renault 2007). For instance, Johnson et al. (2007) demonstrated how consistent standards facilitate ITSM with an example of configuration management database in ITIL. Likewise, international IT standards make the IT service transition less troublesome and help to streamline service operation (Kumbakara 2008). It is therefore plausible to use a standard approach in process assessment (ISO/IEC 15504) and to apply such an approach to standard ITSM processes (ISO/IEC 20000) as both standards have been developed by the same organisations, ISO and IEC, thus fostering greater compatibility and global acceptance (Lepmets et al. 2014). A standard and structured method provides the transparency required to compare outcomes and to measure improvements periodically. In addition, for multinational organisations a standard approach based on ISO and IEC specifications can make an assessment project easy to conduct across the regions. The credibility of ISO and IEC is therefore one of the key drivers in this research. The standards in the area of ITSM and process assessments are established and accepted agreements that makes communication in systems involving people, processes and technology possible and predictable (Getronics 2006).

Part 2 of the ISO/IEC 15504 provides a measurement framework with capability rating metrics (ISO/IEC 2004b), however application of the framework to determine process capability is understandably not explicit in the standard. Surprisingly, none of the academic literature found during the review reported a transparent method to calculate process capability scores. Perhaps this is because most of the assessment data analysis is largely dependent on the subjective judgment of the assessors which is based on their experience (Barafort, Rousseau & Dubois 2014). In cases where a software tool is used, the software only provided a data entry interface for assessors or online surveys by process stakeholders. There is limited discussion on how the collected assessment data is analysed, if it is done so, by any software tools reported. It is reasonable to assume that proprietary software tools and services in the ITSM industry such as PinkSCAN and ITIL assessment services are silent about their data analysis approach due to their commercial value. In this research, there is an opportunity to provide a degree of transparency by demonstrating the assessment data analysis technique and formulas used for such analysis.

The ITIL framework is a widely accepted resource for IT service providers who seek guidance on process improvement (Bernard 2012). However process assessments that are designed to comply strictly with ITIL can be very laborious and pedantic in the way IT services are implemented (Lloyd 2011). Moreover, there are reports from industry experts that strict compliance with the ITIL framework to determine process capability could be misleading (England 2012). In contrast, the ISO/IEC 20000 standard is brief and to the point, unlike ITIL that provides extensive prescriptive guidelines for process implementation. Moreover, the ISO/IEC 20000 standard is aligned with the ITIL framework for consistency (Kempter & Kempter 2013). The ISO/IEC 20000 standard is explicitly designed for audit and assessment; hence it is used in this research to conduct process assessments.

The wealth of knowledge from the ITIL framework can be used to report the outcome of the assessment. According to the literature review, it appears that the process improvement recommendations, which are a part of the assessment report and presented after assessment data analysis, are compiled together manually by the assessors after the assessment activities are completed. The ITIL framework is undoubtedly the most accessible and appropriate resource for ITSM process improvement. This presents a research opportunity to use ITIL for the development of a knowledge base to store specific process improvement recommendations for every assessment question. In this way, whenever a gap in the process capability is detected, i.e. a low process capability score, relevant process improvement knowledge items can be automatically compiled by a DSS and included in the assessment report. This is another research opportunity in ITSM process assessment that has not been previously addressed.

In summary, application of a transparent method in ITSM process assessments promote consistency during repeated engagements in process assessments. Using this method, there is an opportunity to develop an approach of asking questions directly from the ISO/IEC 15504 process assessment model with answer options aligned to the measurement framework of ISO/IEC 15504. There is also an opportunity to transparently demonstrate how assessment data is analysed and how process improvement recommendations are generated. These opportunities provide a framework for consistent data collection and generation of the process profile and an assessment report for process improvement. To exploit these research opportunities, this research proposes a novel method in ITSM process assessment: the Software-mediated Process Assessment (SMPA) approach. An overview of the SMPA approach and a brief introduction of the relevant standards used in this research are discussed next.

2.10 The Software-mediated Process Assessment (SMPA) Approach

In order to exploit the research opportunities in ITSM process assessments as discussed in the previous section, the SMPA approach is proposed in this research. The use of the international standards for process assessment leads to transparency in ITSM process assessments. Moreover, the SMPA approach uses online surveys for data collection and a DSS for analysis and reporting so that the assessment does not require significant effort or resources. The use of a DSS and the process assessment model based on ISO/IEC 15504 are two distinct features of the SMPA approach. These two features are proposed to enhance transparency and efficiency in ITSM process assessments. Table 2.8 presents the SMPA approach and its association with Juran's Quality Trilogy and with the typical activities of ITSM process assessment.

Moving forward in this research, the premise that using the SMPA approach can provide a solution by exploiting the two research opportunities is examined. A detailed design and description of the SMPA approach is provided in Chapter 4. The next section presents a brief review of the three international standards used in the development and evaluation of the SMPA approach.

Table 2.8 SMPA Approach aligned with Juran's Quality Trilogy and ITSM Process Assessment

SMPA approach	Juran's Quality Trilogy	ITSM Process Assessment
Phase 1 Preparation	**Quality Planning**	**Planning (pre-assessment)**
Record organisation profile & assessment goals	Establish quality goals	Establish organisation profiles & assessment goals
Select assessment participants and their process roles	Identify customers	Identify process stakeholders and their roles
Select critical processes to assess	Select products/ processes based on customer needs	Select critical processes to assess and improve
Phase 2 Survey	**Quality Control**	**Assessment Activities**
Conduct online survey of assessment questions based on the process indicators from the ISO/IEC 15504 PAM for ITSM	Evaluate Actual Performance	Data collection about actual process activities
Phase 3 Measurement Calculate assessment profiles using the guidelines from ISO/IEC 15504-2	Compare actual performance with quality goals	Determine process capabilities using process measurement framework
Phase 4 Improvement Generate process improvement recommendations based on the guidelines from the ITIL framework and compile an assessment report	Act on the difference	Provide process improvement recommendations
N/A	**Quality Improvement**	**Process Improvement (post-assessment)**
	Identify and implement the improvement projects	Identify and implement the process improvement projects
	Business gains from quality improvement	Continual service improvement

2.10.1 ISO/IEC 20000

ISO has developed requirements and guidance for ITSM as the ISO/IEC 20000 standard. Initially the British Standard BS15000 was developed based on ITIL in order to describe the ITIL processes in standard terms and more importantly to structure the ITIL processes in order to make them measurable and manageable (Malzahn 2008). Later, ISO/IEC 20000 based on the best practices of ITIL was published as the international standard for ITSM. Since then it has undergone a number of updates and is currently synchronised with the latest ITIL 2011 edition (ISO/IEC 2011b). ISO/IEC 20000 specifies requirements for IT service providers to develop and improve a service management system (ISO/IEC 2012a).

The ISO/IEC Standards Working Group responsible for IT Service Management (ISO/IEC JTC 1/SC 40/WG 2) has also defined a process reference model (PRM) for the assessment of ITSM processes as Part 4 of the standard "that represents process elements in terms of purpose and outcomes" (ISO/IEC 2010). A PRM provides all the indicators to determine process performance at capability level 1 (CL1). The indicators of CL1 are specific to each process. The use of a PRM for improvement provided a platform for transparent ITSM process assessment and it is reported to work well in industry (APQC 2011; IBM 2008).

2.10.2 ISO/IEC 15504

ISO/IEC 15504 is the international standard for process assessment. It defines six process capability levels (CL0 to CL5): CL0 – Incomplete process; CL1 – Performed process; CL2 – Managed process; CL3 – Established process; CL4 – Predictable process; and CL5 – Optimising process. CL0 suggests a lack of effective performance of the process. At CL1, a single process attribute is defined. There are two specific process attributes defined for all the other process capability levels. Therefore a total of nine process attributes (PA1.1 to PA5.2) exist in the measurement framework. At a more granular level, a number of explicit process indicators are defined for each process attribute. These process indicators provide criteria to assess process capability in finer detail (ISO/IEC 2004b). Process assessment is conducted in a standard manner when it is compliant with ISO/IEC 15504-2 requirements where the assessors collect objective evidence against process indicators to determine capabilities of a process (ISO/IEC 2005a). The development of the PRM for ITSM (i.e. ISO/IEC 20000-4) paved the way for the development of an exemplar process assessment model (PAM) for ITSM (ISO/IEC 2012b). A PAM provides generic indicators to determine higher levels of process capabilities beyond CL1.

The availability of the PAM for ITSM in ISO/IEC 15504 is one of the driving forces of this research. Although the combination of ISO/IEC 15504 and ISO/IEC 20000 was studied previously (Nehfort 2007), there are no apparent studies on the use of the combination for ITSM process assessment using the standard PAM. The standard PAM for ITSM process assessment based on ISO/IEC 15504-8 underpins the SMPA approach. The model of ITSM process assessment using the ISO/IEC 15504 standard is illustrated in Figure 2.4.

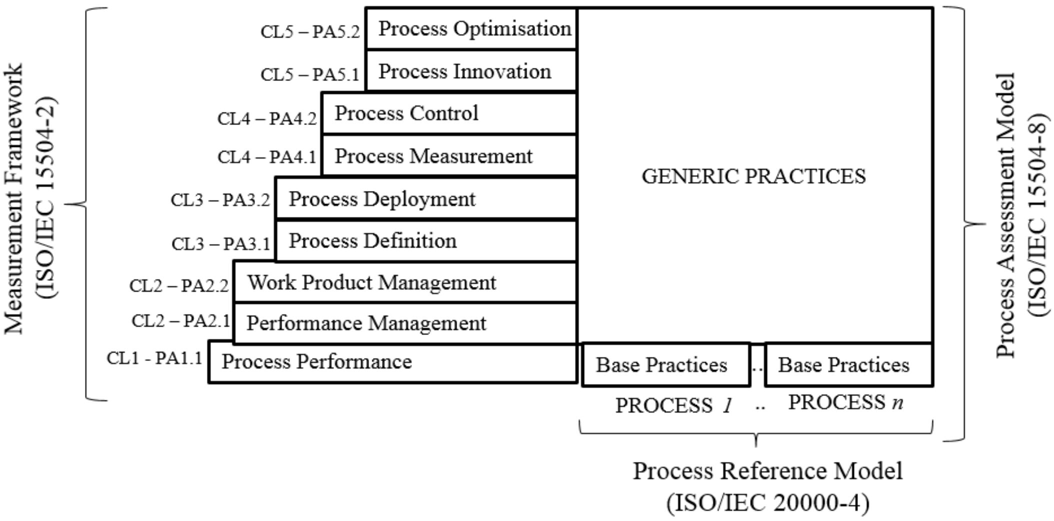

Figure 2.4: ITSM Process Assessment Model (Adapted from ISO/IEC 15504-2)

Beyond the software engineering discipline, the ISO/IEC 15504 standard, originally referred to as Software Process Improvement and Capability DEtermination (SPICE), has now been established as a general process assessment standard and is being transformed into a new standard family of ISO/IEC 330xx series (Rout 2014). The fundamental evolution of the ISO/IEC 15504 standard architecture has opened up the way to other sectors of the industry and new horizons for process assessment (Cortina et al. 2014). Some of the widely recognised projects to extend the use of ISO/IEC 15504 to other sectors include Automotive SPICE, SPICE for Space, Enterprise

SPICE, Banking SPICE and MediSPICE (Cortina et al. 2014; Van Loon 2007). Other SPICE projects on IT security, knowledge management, industrial processes, public university research laboratories and management systems standards (Cortina et al. 2014) are evolving as well.

ISO/IEC 15504-2 also defines a measurement framework for the assessment of process capability that is applicable to Control Objectives for Information and Related Technology (COBIT). The latest COBIT version 5 integrates other major frameworks such as ITIL and ISO/IEC 15504. For many years, COBIT has been used by organisations worldwide to assess and improve their IT processes but a transparent assessment method was lacking until the COBIT assessment programme was introduced in 2011 (De Haes, Van Grembergen & Debreceny 2013). The COBIT assessment programme has recently adopted ISO/IEC 15504 and developed a compliant PAM for the assessment of IT governance processes. The PAM aligned with ISO/IEC 15504-2 is a crucial driver for process improvement in the area of governance and management of enterprise IT (ISACA 2013).

According to the ISO/IEC 15504 standard Part 2 that sets out the minimum requirements to perform an assessment, ITSM process assessment is based on a two dimensional model: a process dimension and a capability dimension (ISO/IEC 2004a) as shown in Figure 2.4. The process dimension is provided by an external PRM. ISO/IEC 20000 Part 4 is the standard PRM for ITSM process assessment. Likewise, the capability dimension consists of a measurement framework comprising six process capability levels and their associated process attributes (ISO/IEC 2004b). Process assessment is carried out utilising a conformant PAM that relates to the compliant PRM. ISO/IEC TS 15504 Part 8 is an exemplar process assessment model for ITSM process assessment. The use of ISO/IEC 20000-4 as the PRM and ISO/IEC 15504-8 as the PAM in this research support the alignment with international standards in the SMPA approach.

2.10.3 ISO/IEC 25010

ISO/IEC 25010 is an international standard that provides quality models for systems and software quality requirements and evaluation, also called SQuaRE, in the discipline of systems and software engineering (ISO/IEC 2011a). Realising the new position of software-as-a-service, the ISO/IEC 25010 standard was expanded in 2011 to include the quality in use dimension for software quality evaluation. A corresponding standard ISO/IEC 25040 describes how the quality models from ISO/IEC 25010 can be used for the software quality evaluation process.

The evaluation of a DSS as a product can be conducted using the product quality model (ISO/IEC 2011a) that comprises eight characteristics, namely: (a) Functional stability; (b) Performance efficiency; (c) Compatibility; (d) Usability; (e) Reliability; (f) Security; (g) Maintainability; and (h) Portability. These characteristics relate directly to the target DSS platform being evaluated. The evaluation of Microsoft Azure (Microsoft 2014), which is the DSS platform for the SMPA approach, is based on the product quality model of ISO/IEC 25010. This is discussed in Chapter 5*, section 5.3.6* in detail.

Likewise, quality in use is the degree to which the DSS can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use (ISO/IEC 2011a). A standard definition of usability is provided in the quality in use model of ISO/IEC 25010 (ISO/IEC 2011a, clause 4.2.4): "usability is defined as a subset of quality in use consisting of *effectiveness, efficiency and satisfaction*, [emphasised] for consistency with its established meaning". Furthermore, based on the standard, *satisfaction* is the user's response to interaction with the software and includes four sub-characteristics: *usefulness, trust, pleasure and comfort* (ISO/IEC 2011a, clause 4.1.3). Hence, the quality in use model is composed of five characteristics and nine sub-characteristics that relate to outcomes of interaction with a system:

- Effectiveness;
- Efficiency;
- Satisfaction:
    - Usefulness;
    - Trust;
    - Pleasure;
    - Comfort;
- Freedom from risk:
    - Economic risk mitigation;
    - Health and safety risk mitigation;
    - Environmental risk mitigation;
- Context coverage:
    - Context completeness; and
    - Flexibility.

It is not usually practical to specify or measure quality in use for all possible user-task scenarios. Usability is a quality characteristic represented in both software product quality and quality in use models, however the context of usability in the two models is different. For the software quality in use model, evaluation focuses on the interaction of the software when applied in the real world involving people who can be primary users, secondary users or other stakeholders (ISO/IEC 2011a). In this context, ISO/IEC 25010 defines usability as a subset of quality in use characteristics, consisting of effectiveness, efficiency and satisfaction. Usability is used to evaluate the quality in use of the DSS in this research. The evaluation process and findings are discussed in Chapter 5 in detail.

2.11 Chapter Summary

The literature review showed there is scant research on ITSM process assessment in comparison with other ITSM studies and research on process assessments in other domains such as software engineering. There is also a lack of a theory-based ITSM process assessment method that also addresses industry requirements of transparency and efficiency. The literature review found limited research studies of methods for ITSM process assessment in comparison with methods for software process assessment even though the measurement frameworks are consistent. None of the studies considered using a DSS that can target process stakeholders directly to collect assessment data and that uses a knowledge base to store and generate process improvement recommendations. Consequently organisations find the task of ITSM process assessment an expensive engagement and lacking in transparency.

Based on the literature review, it is important to address the challenges of ITSM process assessment by proposing a simple yet transparent method for self-assessment in order to improve ITSM processes. Such a method can also be helpful to assessors and consultants for rigorous assessments such as for audit and certification. Hence two research opportunities were justified based on the literature review to highlight the research problem. The SMPA approach was proposed to address the research problem along with a brief introduction to the international standards used to develop and evaluate the SMPA approach.

Based on this premise, a research model is formulated to associate activities planned to develop and evaluate the SMPA approach in this research with the three research questions as introduced in Chapter 1.

Figure 2.5 presents the research model as the major outcome of this chapter.

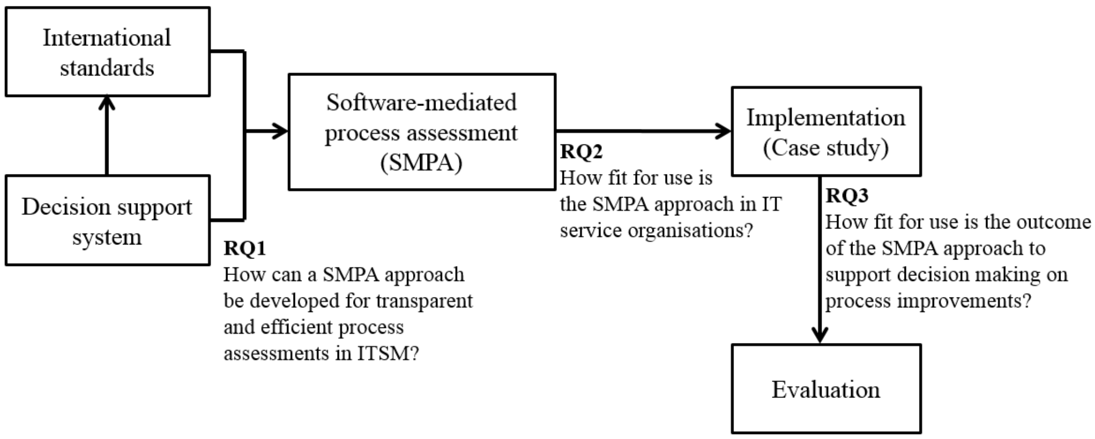

Figure 2.5 Research Model

The arrows in the research model do not represent causal relationship but depict the flow of research activities undertaken to answer the research questions. This chapter presented the research model based on the literature review in order to address the research problem. Based on the research model, this research can proceed with a plan for the research method. This is discussed in the next chapter, Chapter 3 Research Methodology.

Chapter 3. Research Methodology

3.1 Chapter Introduction

Chapter 2 demonstrated the need for this research by clarifying two research opportunities that emerged from the literature review on ITSM process assessment. The literature review demonstrated there is little academic research on ITSM process assessment. Consequently, a novel method, the SMPA approach was described in Chapter 2.

The objective of this chapter is to provide an explanation of the research activity plan in terms of philosophy, design and methods used during this research. Figure 3.1 illustrates an overview of Chapter 3. The study is largely exploratory in nature, particularly during the artefact design and development. The choice of the research methods support data collection that answers the research questions introduced in Chapter 1 and presented in the research model in Chapter 2. Chapter 4 and Chapter 5 provide further details about the actual design, development and evaluation of the SMPA approach.

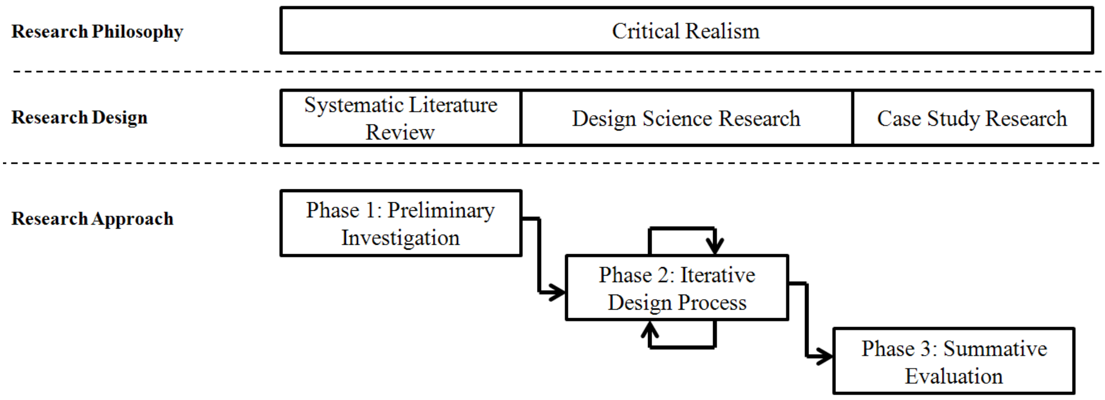

Figure 3.1 Chapter 3 Overview

Chapter 3 has seven sections. This section is an overview of the chapter. Details of the research philosophy are provided in *section 3.2* followed by a description of the research design in *section 3.3*. The research approach consisting of three phases is discussed in detail in *section 3.4*, followed by the justification of the research approach in *section 3.5*. Ethical considerations are discussed in *section 3.6*, followed by a summary and conclusion in *section 3.7*.

3.2 Research Philosophy

Philosophy in business research is largely categorised by the researcher's view of reality (ontology) and stance regarding valid knowledge (epistemology) (Saunders, Lewis & Thornhill 2009). This section discusses research philosophy to consider the ontology and epistemology positions of this research in order to direct the research methods used (Lee 2004). Garcia and Quek (1997) argued that being an applied discipline, IS research concentrates more on the outcomes and methodological issues rather than ontological and epistemological reasoning behind a particular research approach. A greater critical awareness of underlying research philosophy is therefore required. An understanding of ontological, epistemological and methodological concepts for the SMPA approach provides a philosophical view within this research to articulate an innovative solution for ITSM process assessment. Based on these inherent values, this research takes the philosophical worldview of critical realism (Bhaskar 1978) that guides the research design.

Critical realism is a philosophical stance most influenced by the initial work of Bhaskar (1978) where he outlined three domains of the world view: the real; the actual; and the empirical. The term critical realism comes from two philosophies. By critical, which Roy Bhaskar termed as *critical naturalism*, it is realised that social science is too complex to understand human interactions in the social system and therefore must be facilitated by free flowing actions in social structures (Collier 1994). This concept is applied in this research with the choice of a case study research for the evaluation regarding how users interact with a novel approach in a real world setting.

Likewise, realism, or *transcendental realism* in Bhaskar's opinion, focuses on a setting where a researcher engages in an ongoing process to improve the concepts that were used to understand the mechanisms under study (Collier 1994). This is very different to positivism, where it is the associations or relationships between events and objects that are in focus. Contrary to the positivist ontology that attempts to study objective social reality independent of the human activities (Khazanchi & Munkvold 2000), the critical realist stance proposes the existence of the real, the actual and the empirical. The real domain includes underlying structures, events and experiences that exist independently. Events and behaviours in the social world that influence the real domain are categorised as the actual domain. Finally, the domain of the empirical exists where a researcher experiences and measures a part of the actual events (Collier 1994; Mingers, Mutch & Willcocks 2013). In this sense, critical realist ontology is intimately related to the outcomes and practice of research (Dobson 2001). Following the critical realist philosophy, an iterative design process is adopted for the development of a solution-oriented artefact in this research.

Critical realism focuses on explanations of underlying mechanisms that may be unmeasurable. Therefore, an hypothesis for the mechanism may be postulated while acknowledging that the underlying mechanism may never be found (Collier 1994). In such a scenario, an hypothesis can be tested by looking for alternative mechanisms and their effects (Mingers 2004). Mingers (2004) stated that a social system is an open system that can only be closed by force; thereby making the empirical testing of theory highly complex. Therefore, a critical realist epistemology views "science as an ongoing developing process of explanation and enlightenment rather than the derivation of immutable scientific laws …" (Dobson 2001, p. 202). This stance supports the choice of an iterative design process employed as a core research method in this research to develop the research artefact.

There is strong support for critical realism as a suitable governing philosophy in IS as opposed to positivism or interpretivism, for example, Dobson (2001); Mingers (2004); Mingers, Mutch and Willcocks (2013), particularly because this philosophy is flexible to choose a methodology that fits the research requirements (Saunders, Lewis & Thornhill 2009). The epistemological position of critical realism suggests researchers should focus on a specific context (Saunders, Lewis & Thornhill 2009). Moreover, in order to identify structured interactions between complex mechanisms, qualitative methods within critical realism are strongly supported (Zachariadis, Scott & Barrett 2013). Hence the case study research used in the evaluation of the SMPA approach is relevant in this research.

A critical realist stance as an alternative to positivism, traditional realism or constructivism has been proposed for DSR (Carlsson 2012). Since an IT artefact, i.e. a DSS for the SMPA approach, is developed in this research, the design and evaluation are viewed as part of a socio-technical system where design knowledge is developed through an iterative design process.

Table 3.1 summarises how the philosophy of critical realism has driven the entire research process, along with the focus on the unit of analysis and the research questions.

Table 3.1 Overall Research Framework

Research philosophy	Critical Realism
Ontology	*Realist* view of world – a world exists independent of our knowledge, contrary to *positivism* which reduces the world for empirical measurement and many forms of *constructivism* which reduce the world to their knowledge of it (Mingers, Mutch & Willcocks 2013)
Epistemology	*Different forms of knowledge exist* – physical, social and conceptual – therefore a combination of different research methodologies is required
Research type	Exploratory Research
Research topic	Development and evaluation of a software-mediated process assessment approach in IT Service Management
Research problem	There is a lack of a transparent and efficient process assessment method to improve ITSM processes
Research design	Design theory Task-technology fit theory Design science research methodology Case study research
Research approach	Phase 1. Literature review Phase 2. Iterative design process Phase 3. Summative evaluation
Methods of data collection	Participatory research (build-evaluate DSR cycles) Focus group discussion Semi-structured interview
Unit of analysis	"Method" of process assessment, applied at a "group level" (ITSM function in an organisation)
RQ1: (Design Process)	How can a software-mediated process assessment (SMPA) approach be developed for transparent and efficient process assessments in IT service management?
RQ2: (Usability Evaluation)	How fit for use is the SMPA approach in IT service organisations?
RQ3: (Outcome Evaluation)	How fit for use is the outcome of the SMPA approach (assessment report) to support decision-making on process improvements?

3.3 Research Design

In this research, the critical realism philosophy guides Design Science Research (DSR) (Hevner et al. 2004) as the underpinning research design. Design science is a problem solving approach aimed at changing an existing environment to one that better reflects current aims (Boland 2004). In contrast to research methods in IS that are used to explore or confirm hypotheses, this research follows a DSR approach (Gregor & Jones 2007; Hevner et al. 2004) because the primary goal of this research is to develop a new artefact. The artefact, referred to as the SMPA approach, is a method for ITSM process assessments based on international standards and facilitated by a DSS. According to Vaishnavi and Kuechler (2008, p. 13), methods as research artefacts are "goal directed plans for manipulating constructs so that the solution statement model is realized." A detailed description of the SMPA approach for ITSM process assessments is provided in Chapter 4. The DSR research design is particularly suitable for IS research since "the [information systems] field should not only try to understand how the world is, but also how to change it" (Carlsson et al. 2011, p. 109). To guide the design and evaluation of the SMPA approach, a DSS as an IT artefact which represents the SMPA approach is constructed and evaluated. Benbasat and Zmud (2003) argued that an IT artefact should form the core of the IS discipline. There is a strong support for this position in the IS literature (Furneaux & Wade 2009).

If a behavioural research design was followed, various IT service process quality constructs and relationships might have been hypothesised and a statistically tested instrument would have been developed to examine these relationships. For example, Lepmets et al. (2012) followed this research design in the area of IT service quality measures. By contrast, the DSR approach focuses on clarifying the goals of a research artefact in the form of a construct, method, model, or instantiation (March & Smith 1995) and on building the artefacts and evaluating their utility (Hevner et al. 2004; Venable 2006). A major contribution of a DSR study is to develop at least some components of a design theory. The concept of design theory is presented next.

3.3.1 Design Theory

Gregor (2006) distinguished five interrelated types of theory and stated that all types of theory can inform the Type V: "Theory for design and action". Knowledge of people and technology can inform the design of new IS artefacts based on a design theory (Gregor 2006). Specifically in IS, DSR follows a research approach to create and evaluate IT artefacts intended to solve identified organisational problems (Hevner et al. 2004). A design theory can govern research design based on different types of extant theories, i.e. kernel theories (Hevner et al. 2004; Iivari 2007; Walls, Widmeyer & El Sawy 1992); case studies (Van Aken 2005, 2006) and systematic literature review (Carlsson et al. 2011). All the three types are used as components of design theory in this research.

Walls, Widmeyer and El Sawy (2004, p. 45) described the purpose of design theory as being "to guide artefact creation". Design theory is differentiated from natural and social science research by stating that in DSR, "the achievement of goals" is fundamental (Walls, Widmeyer & El Sawy 1992, p. 40). This contrasts with natural and social science research that seeks to explain or predict phenomena (Gregor 2006). Design theory puts explanatory, predictive and normative theory into practical use by designing an artefact to meet a goal. This may seem to contradict the previously stated critical realist philosophical stance. However, Carlsson (2006) argued that critical realism is an appropriate philosophy for DSR because, although the goal is to produce an IT artefact that will work for a class of problems, that IT artefact must be evaluated within the socio-technical environment that forms its context. This context and DSR methodology has guided the design process to develop the artefact in this research.

The goal of a DSR project is the successful application of the designed object to make required changes in an environment. Walls, Widmeyer and El Sawy (1992) based their design concept on Simon's (1969) argument for a formal methodology to govern design. A fundamental concept of a design theory is that the "design is both a product and a process" (Walls, Widmeyer & El Sawy 1992, p. 42) and consequently, that the application of design theory methodologies is as important as the evaluation of the designed artefact. They stated that the design process to produce the artefact requires three elements:

1. A *kernel theory* from the natural or social sciences so that the design process is driven by extant process theory. Task-technology Fit (TTF) theory (Zigurs & Buckland 1998) is used in this study as the major kernel theory for the design process.
2. A *design method* that describes how the artefact is constructed. A fit profile based on TTF theory and the iterative design process (*section 3.4.2*) provide an explanation of the design method. An explanation of the design method also answers RQ1 in this research.
3. A *testable design process hypothesis*, to evaluate whether the designed artefact meets the standards of its design class. DSR guidelines from Hevner et al. (2004) are used to evaluate the design process and are discussed as part of the research method evaluation in Chapter 5, *section 5.4.4*.

Furthermore, the designed product, i.e. the SMPA approach in this research, is required to meet four major requirements (Walls, Widmeyer & El Sawy 1992):

1. A *kernel theory*, as the artefact must be informed by the extant theory. A total of seven frameworks are used as the kernel theories to design the artefact in this research. The seven frameworks include:

    a. Balanced Scorecard (Kaplan & Norton 1992) – a business performance model;
    b. SERVQUAL model (Parasuraman, Zeithaml & Berry 1985) – a service quality measurement model;
    c. ISO/IEC 15504 (ISO/IEC 2004b) – international standard for process assessment;
    d. ISO/IEC 20000 (ISO/IEC 2011b) – international standard for ITSM;
    e. Goal-Question-Metric approach (Basili, Caldiera & Rombach 1994) – a process measurement model;
    f. Decision support systems (Shim et al. 2002) – technologies that support decision-making; and
    g. ITIL framework (TSO 2011) – industry best practice guidelines for ITSM.

2. *Meta-requirements* that provide an understanding of the system requirements necessary in a solution to the identified problem. Two research opportunities that emerged from the literature review (Chapter 2, *section 2.9*) are presented as meta-requirements for the research artefact.
3. *Meta-design* is knowledge of the types of artefacts shown to provide a solution in a problem domain. The phases of the SMPA approach presented in Chapter 4 provide the meta-design for this research project.
4. A *testable design product hypothesis* is a plan to evaluate whether the designed artefact meets the requirements. Evaluation of the usability of the SMPA approach and the outcome of the SMPA approach address this requirement in the research. Chapter 5 presents the evaluation results.

The relationship between the design process and design product requirements was first illustrated as a design theory by Walls, Widmeyer and El Sawy (1992). In a later paper (Walls, Widmeyer & El Sawy 2004), some of the discussions of the 1992 paper were critiqued but the model of the design theory remained the same. Markus, Majchrzak and Gasser (2002, p. 180) stated that the contribution of the IS design theory is to "articulate the boundaries within which particular design assumptions apply". This means design theory can contribute to a class of problems within a rigorous research method by designing an artefact that introduced change in an environment. Figure 3.2 shows how the information systems design theory proposed by Walls, Widmeyer and El Sawy (2004) is adapted to explain the design theory for this research.

March and Smith (1995) drew upon Simon's (1969) work to discuss design science but did not reference Walls, Widmeyer and El Sawy (1992). It was stated that "rather than producing general theoretical knowledge, design scientists produce and apply knowledge of tasks or situations in order to create effective artifacts" (March & Smith 1995, p. 253). This implies that the focus of the design is on producing relevant artifacts "by creat[ing] things that serve human purposes" (March & Smith 1995, p. 253) at the expense of building design theory. This approach of centring the design method on the output of the methodology – rather than on the theory built during the process of design – was critiqued by Walls, Widmeyer and El Sawy (2004). They argued that purely focusing on the output is just design practice "while design *science* [emphasised] should create theoretical foundations for design practice" (Walls, Widmeyer & El Sawy 2004, p. 48).

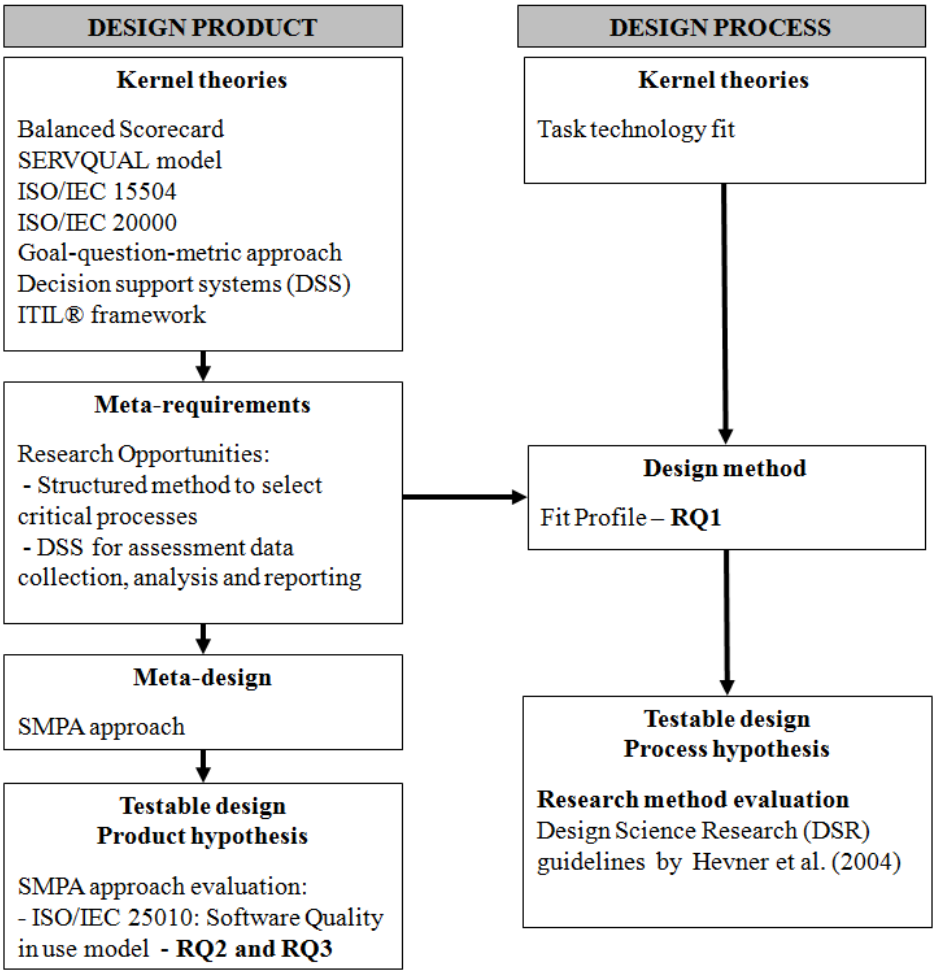

Figure 3.2 Components of Research Design Theory based on Walls, Widmeyer and El Sawy (2004)

Recent authors have agreed with Walls, Widmeyer and El Sawy (2004) but also recognised the value of relevance in the design science work so that the artefacts produced are applicable in industry. New DSR guidelines therefore suggest maintaining a balance between relevance and rigour (Kuechler & Vaishnavi 2011) and provide methodological guidance that promotes both academic rigour and practical application of the design process and product. Gregor and Jones (2007), Kuechler and Vaishnavi (2008), Hevner et al. (2004) and Venable (2006) supported the need to maintain a balance between academic rigour and industry relevance in DSR. Nonetheless, Baskerville (2008, p. 442) referred to the theory developed by design science as “theory discovery” where the theory is a by-product of the process of developing an artefact. Morevoer, Winter (2008, p. 472) referred to design theory as an “intermediate artefact” that should be one of the artefacts resulting from DSR. The design process and resultant artefact have to be at least generalised to a class of problem domains in DSR (Winter 2008). This position corresponds to the definition of meta-requirements and meta-design by Walls, Widmeyer and El Sawy (1992) in their proposed design theory. This DSR study attempts to balance both relevance and rigour (Kuechler & Vaishnavi 2011) with the application of design theory components to provide a solution to the problem of the lack of transparency and need for efficiency in ITSM process assessment.

This research is conducted in a socio-technical context for the development and evaluation of the artefact. Hence the design of the final research artefact is influenced by the environment where it operates. As shown in Figure 3.2, there are two categories of kernel theories. A kernel theory is defined as a theory “from natural or social sciences governing design requirements” (Walls, Widmeyer & El Sawy 1992, p. 43; 2004). Kuechler and Vaishnavi (2008) and Gregor (2006) supported this definition. Since a kernel theory can inform artefact construction (Gregor & Jones 2007), TTF theory is used as the major kernel theory for the design process in this research. Using this theory, a fit profile between the task challenges and technology requirements is established to provide design principles for the development of the SMPA approach. TTF theory is discussed next.

3.3.2 Task-Technology Fit Theory

In DSR projects, researchers are advised to use established kernel theories to inform and justify the research work (Venable 2006). TTF theory (Zigurs & Buckland 1998) is applied as the kernel theory for the design process in this research to advise how the task challenges of process assessment and technology requirements for a new DSS fit together to articulate the artefact design and development. TTF theory informs the match between user task needs and available technology features (Dishaw & Strong 1999). The choice of TTF theory is justified by the core focus of this research to build a technology solution in response to task challenges, i.e. the lack of transparency and need for efficiency in ITSM process assessments.

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 & Thompson 1995). The theory 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 (Gu & Wang 2009). TTF theory was later applied to evaluate group performance by verifying the fit with group support systems technology (Zigurs & Buckland 1998). In subsequent research, key constructs of TTF theory were operationalised using coding instruments and the theory was methodically supported (Zigurs et al. 1999).

Along with the technology acceptance model (TAM) by Davis (1989), TTF theory provided a basis to explore factors associating technology with user performance – therefore an extension of TAM to include TTF constructs was proposed (Dishaw & Strong 1999). Likewise, other researchers used TTF theory and integrated this theory with different constructs such as TTF and uncertainty in information seeking (D'Ambra & Wilson 2004), TTF and social cognitive theory to understand knowledge management systems (Lin & Huang 2008) and TTF with self-efficacy constructs for software utilisation choices of end users (Dishaw, Strong & Bandy 2002). Since then the theory has been applied to a diverse range of IS research and is considered one of the prominent theories to explain the impact of IT on performance (Gebauer, Shaw & Gribbins 2010).

In this research, TTF theory from Zigurs and Buckland (1998) is considered suitable as a kernel theory to explain the entire design process for two primary reasons: (a) the DSS proposed in the SMPA approach shares similar technology dimensions as proposed in the theory, viz. communication support, process structuring and information processing; and (b) the design principles established based on a fit profile to match task and technology is supported by this theory.

A model of TTF theory as applied in this research is presented in Figure 3.3. The task is represented by a typical decision task to select ITSM processes to assess and to improve processes based on assessment results. The technology requirements are provided by a DSS with *process structuring* and *information processing* dimensions to match the decision task as supported by TTF theory (Zigurs & Buckland 1998). A fit is proposed as the research artefact in this project: the SMPA approach. Finally the performance of the fit is determined through evaluation of the usability of the SMPA approach.

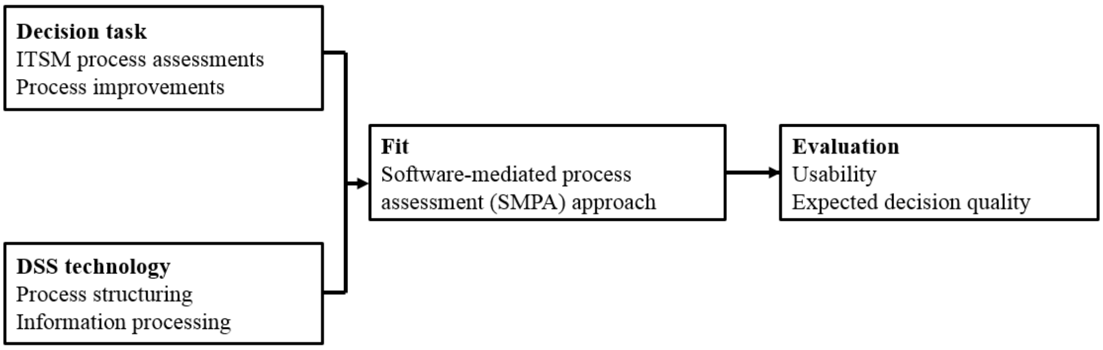

Figure 3.3 TTF Model for this Research based on Zigurs and Buckland (1998)

TTF theory has been recognised as a very important development in IS theory to evaluate existing technologies in order to fit with different task types (Hoehle & Huff 2012). The concept of fit in TTF theory has been primarily quantified in terms of two approaches – deviation-score analysis and parallel instruments – between two or more variables (Hoehle & Huff 2012; Klein, Jiang & Cheney 2009). In this research, TTF theory is applied to rigorously explain the design process for a new technology development before evaluation of the task-technology fit can proceed. The integration of TTF theory with DSR methodology is an important kernel theory to guide artefact design in this research. The DSR methodology is discussed next.

3.3.3 Design Science Research Methodology

In IS, the DSR methodology (DSRM) has been referred to as "improvement research" as it aims to produce and apply knowledge to create effective artefacts (Vaishnavi & Kuechler 2008, p. 46). The creation of such research artefacts and their evaluation is central to DSRM. This research draws on the DSRM framework and methodological guidelines for IS research suggested by Peffers et al. (2008). DSRM insights from Gregor and Jones (2007), Hevner et al. (2004) and Vaishnavi and Kuechler (2008) are referenced for additional guidance.

This research investigates how the SMPA approach can be used by IT service providers to facilitate transparent and efficient process assessments and therefore support decision-making on process improvements. In this sense, this research is seeking a solution to a design science problem (March & Storey 2008). Two research opportunities listed in Chapter 2, *section 2.9* based on the literature review provide the motivation to develop an artefact as a solution to the identified research problem. To address the research opportunities, this research focused on the development of a structured method to select critical processes to assess and the development of a DSS to automate assessment data collection, analysis and reporting activities. Although common design science projects in IS research have produced IT artefacts such as software applications (instantiations), DSR has also been used to develop rigorous methods in the past, such as a method to measure the strategic fit of a firm's IS (McLaren et al. 2011). On a similar note, this research project is focused on the development of a method as an artefact, the SMPA approach.

DSRM (Peffers et al. 2008) is applied to structure the research design. The six DSRM steps suggested by Peffers et al. (2008): problem identification and motivation; objectives of a solution; design and development; demonstration; evaluation; and communication are followed in the research approach. DSRM provides a structured method to conduct DSR in IS research and this has been reported to work well for accounting information systems research (Geerts 2011).

TTF theory discussed in *section 3.3.2* and DSRM are integrated as one of the kernel theories and used to explain the development and evaluation of the SMPA approach in this research. This integration in the research approach is illustrated in Figure 3.4.

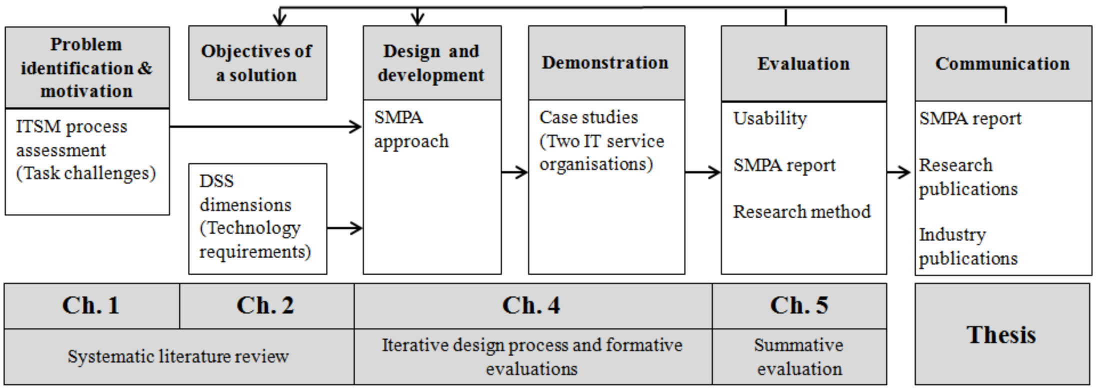

Figure 3.4 Research Approach (Adapted from Zigurs and Buckland (1998) and Peffers et al. (2008))

The concept of fit articulated by TTF theory in terms of matching task challenges and technology requirements aligns with the primary objective of DSR to develop a research artefact as a solution to identified problems. The research artefact can be described using a fit profile where challenges of process assessment (task challenges) are addressed using the technology dimensions for a DSS from TTF theory. Therefore, the justificatory knowledge for the research process shown in Figure 3.4 is a major kernel theory in this research.

Addressing transparency and efficiency are two major challenges of ITSM process assessment that were introduced as the research problem in Chapter 1. The research problem represents the first DSRM phase of *problem identification and motivation.* These two *task challenges* are taken into account as the motivation to conduct this research in order to solve the problem.

The identification of the research opportunities in Chapter 2, *section 2.9* provided technology requirements for the development of an artefact. The second DSRM phase: *objectives of a solution* can be defined from the three technology dimensions derived from TTF theory (Zigurs & Buckland 1998): communication support; process structuring; and information processing. The SMPA approach uses the technology dimensions as *technology requirements* to facilitate assessment workflow and automate assessment activities using DSS technology. Chapter 2 provided a model for this research to proceed with artefact design and development.

Ultimately alignment between task challenges and technology requirements is represented with an ideal fit profile that proposes a set of design principles for the development of the *SMPA approach*. The process of building the fit profile and then the SMPA approach aligns with the *design and development* phase of DSRM. This phase is predominantly exploratory in nature. Zikmund et al. (2012) suggested exploratory research is appropriate for the use of a new phenomenon to resolve problems. Several iterations of design and development effort based on kernel theories, formative evaluations and feedback from discussions on intermediate results are undertaken before the final version of the SMPA approach is produced. Chapter 4 discusses the artefact design and development phase in detail. The next phases of DSRM *demonstration* is also discussed in Chapter 4.

This research is primarily qualitative in terms of the *evaluation* phase in DSRM. The utility of the SMPA approach cannot be determined by analysing quantitative data gathered from the DSS in the SMPA approach since DSS collects process assessment data from the case study organisations and not the research data. It must be clarified that the online survey in the SMPA approach is not a research instrument of this study but a part of the proposed research artefact. The method of using online surveys for ITSM process assessments is what the research investigates. *Usability* of the DSS in the SMPA approach is evaluated to determine relevant quality measures of the DSS. The outcome of the SMPA approach, represented by the *SMPA report*, is compared with the outcome of a manual process assessment conducted by a panel of certified ISO/IEC 15504 assessors using the RAPID process assessment methodology (Cater-Steel, Toleman & Rout 2006) at the case study organisations. Finally, process managers at the case study organisations are interviewed to understand their expectations of quality in decision-making for process improvements using the SMPA approach. The *research method* of this study is also evaluated according to the DSR guidelines by Hevner et al. (2004). Chapter 5 discusses the artefact evaluation phase in detail.

Finally the last phase of the DSRM, *communication*, represents presentation of the entire thesis as a significant outcome along with the delivery of the *SMPA report* to the case study organisations. Moreover, intermediate research results are intended to be presented at academic and practitioner communities for further refinement and development of the SMPA approach, as illustrated in the feedback cycles of the DSRM phases.

3.3.4 Case Study Research

A case study is described by Yin (2009, p. 18) as an “empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context”. Three characteristics of a research project that make it suitable for a case study approach are: the type of research question; the amount of control over behavioural events; and whether the focus is on contemporary or historical events (Yin 2009). For this study, the research questions are concerned with overcoming challenges that exist in ITSM process assessment methods and how a new method could be developed to address the challenges. Therefore, the focus of this research is on a contemporary context that attempts to address existing challenges using an artefact and then to evaluate the artefact. These research conditions met criteria for suitability for a case study approach as suggested by Yin (2009). A case study approach is also suitable for this research as it covers a range of evidence that needs to be captured. The evidence includes review of existing methods of ITSM process assessments, and evaluation from semi-structured interviews and focus group discussions. In case study research, a crucial requirement is to have ready access to the organisation that allows the researcher to develop an understanding of the processes and the people (Gummesson 2000). This research project had support from an industry partner for artefact development and two IT service provider organisations as case study organisations that provided an appropriate context for the evaluation of the artefact.

A quantitative methodology must have a large sample to generalise but the generalised knowledge may not apply to all practices especially for highly contextual studies. In sharp contrast, case study research facilitates exploration of a rich phenomenon in a small number of samples (Cua & Garrett 2009). Recognising the risks associated with a purely inductive approach in case study research (Yin 2009), relevant international standards and literature were used in order to provide some “pre-structure” to guide artefact development and evaluation. Such inductive-deductive interactions are considered practical in business research (Saunders, Lewis & Thornhill 2009).

3.3.4.1 Overview of the case study organisations

Two case study organisations that provide IT services are recruited to evaluate the research artefact. CITEC, the largest IT service provider for the Queensland Government is based in Brisbane, Australia. The ICT department of Toowoomba Regional Council (TRC) is based in Toowoomba City in Queensland, Australia. The two organisations committed to participate in this research as part of a multi-party agreement of the ARC project. It was expected that the two organisations would offer active participation and engagement in the research project for a period of two years during the development of the SMPA approach and particularly during its evaluation.

For comparison purposes, the selection criteria required cases to be operating within the same industry sector and exhibit process improvement as their key objective to conduct ITSM process assessments. In this research, both organisations are public sector IT service providers with a focus on continually improving their ITSM processes. This facilitates comparison and theoretical replication among similar entities, while reducing extraneous phenomena and cross-industry differences (Weill & Olson 1989; Yin 2009). At the same time, the two cases need to enable comparison and contrast on several other profiles to facilitate a richer cross-case view. A detailed description of the two case study organisations is presented in Chapter 4, *sections 4.3.1* and *4.3.2*. A brief overview of the profiles of the two cases compares salient features as presented in Table 3.2.

Table 3.2 Overview of Case Study Organisations

Profile Attribute	**CITEC**	**TRC ICT**
Approximate number of staff	High (430)	Low (50)
Supplier profile	Internal and external supplier	Internal supplier only
Geographic spread	National (Australia-wide)	Regional
Approximate annual budget	High (> AUD$100 million)	Low (<AUD$15 million)

Funding centre	Profit centre	Cost centre
Level of support for assessment	Senior management	C-level (Board)
Predominant focus	Restructure	Steady growth
Past assessment experience	Yes (informal self-assessments)	No
Business driver for process improvement	Service availability and reliability	Continual improvement

3.4 Research Approach

The research approach follows a typical DSR (Hevner et al. 2004) project with the focus on developing the SMPA approach as the research artefact. Following Baskerville, Pries-Heje and Venable (2009) and based on the research design discussed in *section 3.3*, this research involves three design iterations:

(a) *Specify the problem and goals of a solution***.** This is undertaken through a literature review of the existing ITSM process assessments to demonstrate their challenges and two research opportunities to address their shortcomings. Chapter 2 presented the literature review in detail.
(b) *A search for a satisfactory design.* This phase focuses on the development of a method to assess ITSM processes in a transparent and efficient manner to improve IT services. Chapter 4 describes the SMPA approach and the iterative design process in detail.
(c) *Construction of a satisfactory example.* This phase concentrates on the implementation of the SMPA approach as a prototype DSS for its application in real organisations. Chapter 4 also discusses the DSS demonstration at two case study organisations.

Both design and implementation are justified using prior theory and new case study evidence. To ensure the SMPA approach is grounded in theory and empirical evidence, it is developed using exploratory research methods in applying relevant theories and managerial feedback from case study evidence (Eisenhardt 1989b). Besides the articulation of the SMPA approach developed in this research as the design product, the research consists of actionable propositions related to the design process as well. The research therefore presents the SMPA approach as a component of a process theory (Markus & Robey 1988) or a "theory for design and action" (Gregor 2006, p. 611), rather than a causal theory.

This project has three overlapping but distinct phases: (1) preliminary investigation; (2) iterative design process (RQ1); and (3) summative evaluation (RQ2 and RQ3). These phases are described in the following three sections.

3.4.1 Preliminary Investigation

A literature review was executed to review primary studies surrounding ITSM process assessments and identify research opportunities in order to propose the SMPA approach. This phase is discussed in detail in Chapter 2.

The research model presented in Chapter 2, Figure 2.5 for the proposed SMPA approach comprising three research questions is the main outcome of this phase. The model is used to proceed with the development of the SMPA approach.

This phase ensures that the design process is not purely motivated by the need for a solution in industry but is grounded on theoretical shortcomings and a literature gap in the class of problems justified through a literature review.

3.4.2 Iterative Design Process (RQ1)

This section briefly describes the iterative cycle of design and development of the SMPA approach. This phase is discussed in detail in Chapter 4. A participatory research approach is undertaken for the development of the SMPA approach as this can produce “knowledge used in action” (Cornwall & Jewkes 1995, p. 1667). White, Suchowierska and Campbell (2004) agreed that participatory research can produce relevant research. Some of the characteristics of participatory research suggest that the problem may originate from the workplace itself and the ultimate goal is fundamental transformation and improvement (Hall 1981). In this instance the community being studied comprises ITSM staff who work in the Queensland IT industry, and who showed concern about the problem by joining this research project to trial a solution that addresses the challenges in ITSM process assessments. Once a clear definition of the problem under study is made and the technology requirements for a solution are determined, an artefact could be developed that is immediately useful in practical ITSM process assessments (White, Suchowierska & Campbell 2004).

This project has a research team comprising eight members who actively participated in the iterative design and development of the research artefact. Other members of the research team include three senior ITSM practitioners, hereafter coded as P1-P3; three senior academic staff with research profiles in ITSM, coded as A1-A3; and one senior academic who is an expert of the international standard for process assessment coded as S1. A brief profile summary of the research team members is presented in Table 3.3. While this thesis reports the research journey of this researcher, the role of the experts in the research team is to ensure that the research design process is based on valuable industry insights as well as to ensure that the research methods used are valid and rigorous.

This researcher’s involvement in the research commenced after the research project had been planned by the academic staff, approved by the ARC, and the industry partners had committed to the project. The DSS platform for the research artefact had already been developed. Thereafter this researcher reviewed the literature and relevant artefact components to work on the design and development of the SMPA approach using the provided DSS platform.

The two international standards ISO/IEC 20000 and ISO/IEC 15504 are secondary data sources that are analysed in depth in order to extract information as an input to develop the artefact. Most relevant documents are the published technical report Part 4 of ISO/IEC 20000, i.e. the PRM (ISO/IEC 2010) and Part 8 of ISO/IEC 15504, i.e. an exemplar PAM for ITSM (ISO/IEC 2012b). Based on the standards, a process assessment questionnaire is developed for four ITSM processes chosen by the two case study organisations. The questionnaire is incorporated in the DSS as an online survey. Chapter 4, *section 4.2.1* illustrates the workflow that was followed to develop and incorporate the questionnaire into the DSS.

Table 3.3 Research Team Members

Code	Relevant qualification	Relevant experience (no. of years)	Other relevant information
ITSM practitioners			
P1	ITIL Expert	26 years	ITSM consultant; over 10 years of IT senior management experience; publication and presentation at industry outlets
P2	ITIL Expert	30 years	ITSM consultant; over 10 years of IT senior management experience
P3	ITIL Certified	20 years	Managing Director for a large ITSM software vendor
International standards committee member for ISO/IEC 15504			
S1	Associate Professor	24 years in the international standards community	Senior committee member for ISO/IEC 15504 standard; certified lead assessor for ISO/IEC 15504 assessments and CMMI appraisals; publications in high quality outlets in the area of software process assessment
IS academic staff			
A1	Professor	21 years in industry and 20 years in academia	Certified assessor for ISO/IEC 15504 assessments; ITIL and ISO/IEC 20000 certified; actively manages research group on ITSM; actively engages with itSMF industry group
A2	Professor	30 years	Publications in high quality outlets in the area of ITSM
A3	Senior Lecturer	38 years in industry and 15 years in academia	ITIL and ISO/IEC 20000 certified; relevant industry skills in IT project management; publications in high quality outlets in the area of ITSM
This researcher (PhD student)			
	PhD Student; Postgraduate in IT	7 years in industry and 4 years in academia	Certified and trained in ITIL & ISO/IEC 15504; Software development & IT project management industry background

Besides studying the international standards, a number of relevant frameworks and guidelines are used in the design and development of the artefact. Iterative design discussions among the research team members, formative evaluations of the intermediate artefact outcomes, and feedback from the presentation of intermediate results of this research work in academic and industry outlets contribute to the application of relevant frameworks to develop the artefact. Other frameworks used in the SMPA approach are the Balanced Scorecard and the SERVQUAL model to select critical processes to assess; the Goal-Question-Metric (GQM) approach to organise assessment questions; the ITIL framework for process improvement ecommendations; and the DSS technology with a knowledge base for assessment reporting.

Technical software development is not required for the development of the DSS in this research. This is because a fully functional DSS platform for process assessment is provided by the principal industry partner (AP) of this research. AP is one of the world's leading automated assessment service providers for different management systems including ITSM. The use of AP's industry-validated and robust DSS platform facilitates the SMPA approach to conduct ITSM process assessments. Therefore, discussions on software development methodologies, technical software requirements engineering and testing are beyond the scope of this research. However, a brief technical specification of the DSS platform is provided in **Appendix B** (p. 243).

This research contributes towards the development of the SMPA approach in terms of four deliverables:

a) A *structured method* to select processes to assess and improve based on the Balanced Scorecard and the SERVQUAL model;
b) *ITSM process assessment questions* based on the ISO/IEC 15504 standard guidelines and structured using the GQM approach;
c) A *process profile* by calculating process capability scores and score reliability metrics based on the ISO/IEC 15504 measurement framework; and
d) An *assessment report* that includes process improvement recommendations based on the ITIL framework.

During the development of the SMPA approach, several iterations of formative evaluations are conducted as part of the "build-evaluate" design cycle (Hevner 2007). The iterative design process cycle ensures the validity of the SMPA approach and its compliance with the international standards. The feedback from the industry partners (P1-P3) and the standards committee member (S1) in regards to the survey questionnaire, process rating calculations and generation of recommendation reports are all taken into account by this researcher to ensure content validity of the SMPA approach. In fact, the cycle of development and formative evaluation is crucial to develop the SMPA approach to its final stage before the summative evaluation takes place. Therefore, several iterative cycles of development, validation and testing of the SMPA approach took place during the artefact design and development. The final SMPA approach is then demonstrated at two case study organisations. RQ1 is answered based on the iterative design process and explained in Chapter 4 in detail. The summative evaluation phase is discussed next.

3.4.3 Evaluation (RQ2 and RQ3)

This section briefly describes the summative evaluation of the SMPA approach. The evaluation outcomes are discussed in detail in Chapter 5. Evidence from two IT service organisations is gathered to evaluate the SMPA approach. The SMPA approach is evaluated with qualitative evidence to determine its usability. Using a range of informants from two cases ensures the evidence covers a range of ITSM processes and participant experiences.

In this study, triangulation is used to converge understanding from the case study evaluations. The methods used in the study for evaluation are semi-structured interviews and focus group discussions. A chain of evidence is maintained by building a database of information gathered and by referencing comments to participants where possible. Every endeavour is made to cross reference evidence in the assessment report to the data gained during the interviews (Yin 2009). The interviews and focus group discussions are transcribed. Data reduction is achieved by analysing these documents and coding themes or clusters of ideas that are then stored as an annotated document. The themes or clusters of ideas are indexed by a coding system that allows a final evaluation (Huberman & Miles 1994).

3.4.3.1 Usability Evaluation (RQ2)

A focus group discussion is considered an accepted data collection method for evaluation by gathering people sharing similar experiences to discuss a specific topic of interest (Stewart, Shamdasani & Rook 2007). Discussions are guided by a facilitator who introduces topics for discussion and directs the group to participate in a lively and natural discussion among themselves (Krueger & Casey 2009). This researcher and one of his supervisors, A1 share the role of focus group facilitator. When one is the active facilitator, the other research team member records notes that are cross-checked with the recorded interview data. The focus group is conducted at each organisation after the online assessment survey but before the assessment report is submitted to ensure the evaluation is purely focused on the usability of the SMPA approach rather than the outcome of the SMPA approach. All survey participants are requested to attend the focus group discussion at each organisation.

Since this research uses quality as the central concept to guide ITSM process assessments according to the literature classification model (Chapter 2, Figure 2.3), quality characteristics relating to use of the DSS are decided to be the most relevant evaluation factor. Consistent with the use of international standards for ITSM and process assessment in the development of the SMPA approach, the international standard ISO/IEC 25010 provides a software quality in use model (ISO/IEC 2011a) that is used to evaluate the usability of the SMPA approach. It is reasonable and practical to follow international standard guidelines for evaluation after the experience of using international standard guidelines for the development of the artefact.

An overview of the ISO/IEC 25010 quality in use model was provided in Chapter 2, *section 2.10.3*. Five quality characteristics of software quality in use are considered for evaluation: effectiveness; efficiency; usefulness; trust; and comfort. The focus group discussion questions considered for evaluation are provided in **Appendix F.3** (p. 267). One of the strengths of a focus group discussion that is particularly relevant for the evaluation phase in this research is to allow the participants to provide their opinions on agreeing or disagreeing with each other, therefore enabling this research to gain an insight into how a group thinks about an issue (Morgan 1997).

The environment in which the SMPA approach is deployed is complex and dynamic. There are three possible process roles of a single IT service staff – process manager, process performer or external process stakeholder – for any particular process. There are cases where a single individual assumes multiple roles for different processes and is requested to complete multiple questionnaires in the assessment survey with a different role and a need to put on a different “thinking cap”. The quality attributes provide a structure for rich qualitative evaluation in order to understand the complex context in which process assessments are conducted. Moreover, specification of quality characteristics for evaluation provides initial “themes” for content analysis of the transcribed data from the focus group discussions.

A second set of usability evaluations in terms of the experience to facilitate the SMPA approach is conducted with the assessment facilitator at each case study organisation. The assessment facilitator is interviewed about their experience to organise activities for the SMPA approach. Since the assessment outcome is not available at this point as the assessment reports are not released, this semi-structured interview solely focuses on the experience of the assessment facilitator with using the DSS in the SMPA approach. It is important that this interview occurs before the release of the assessment reports since this interview is conducted to evaluate the usability of the DSS and not about the outcome of the SMPA approach. If this interview is scheduled after the assessment reports are presented, it could provide biased evaluations based on the assessment outcome rather than the assessment facilitation process.

The knowledge gained from the usability evaluation during the qualitative research is subsequently provided as an input to the research partner for further improvement of the DSS used in the SMPA approach. This research work is used to answer RQ2.

3.4.3.2 Manual Assessment for Comparison

A conventional process assessment is conducted at each case study organisation to compare and contrast with the SMPA approach and discuss the findings. The conventional process assessment, hereafter referred as the *manual assessment*, uses the RAPID assessment methodology based on ISO/IEC 15504 (Cater-Steel, Toleman & Rout 2006). The manual assessment is conducted as a full one day exercise at each case study organisation.

The order in which to conduct the SMPA approach and the manual assessment is considered irrelevant and they are conducted independent of each other at two organisations. However, there are two factors that are common in both assessment approaches:

(a) This researcher is involved in both approaches as part of the research work. However there is no bias in the outcome of the assessments. Assessment results from the manual assessments are decided by the expert assessors while assessment results from the SMPA approach are calculated by the DSS based on the survey responses.
(b) The same processes are selected for both assessments at each organisation. This is required to conduct a meaningful comparison of the two assessment reports and for the process managers to have a reference to evaluate the outcome of the SMPA approach.

Both the manual assessment and the SMPA approach produce assessment reports as the major outcome. Neither case study organisation had past experience of formal process assessments of their ITSM process capability. Therefore, the manual assessment exercise does not only provide this researcher an opportunity to compare the assessment reports, but it also provides a reference point to the process managers for comparison of the two methods.

The reports from the manual assessment and the SMPA approach are compared to evaluate the outcome of the SMPA approach. In analysing this data, the corroboration of results are checked and contradictions are probed using follow-up interviews and clarifications in person or by e-mail (following Eisenhardt 1989b; Yin 2009). Any contradictions lead to an opportunity for further design search to develop a more refined SMPA approach which is reported to the research partner as recommendations for improvement. This research however conducts only one DSS implementation cycle. Nevertheless, the experience of being part of two different assessment methods may enable process managers to compare the outcome of the manual assessment with the outcome of the SMPA approach, which is discussed next.

3.4.3.3 Outcome Evaluation (RQ3)

The concepts of expected decision quality and expected decision efficiency are applied to evaluate the effectiveness and efficiency of the decision outcome based on the assessment report from the SMPA approach, hereafter referred to as the *SMPA Report*. In the outcome evaluation, four usability characteristics are used for evaluation based on the software quality in use model: effectiveness; efficiency; usefulness; and trust. These four factors are used to evaluate the SMPA Report based on process managers' expectations of how the report may support quality decision-making on process improvements.

Due to the temporal nature of the three-year research project in which two years is spent on the iterative design and development of the SMPA approach, a fully comprehensive evaluation of the SMPA approach is not possible in less than one year. Moreover evaluation of the actual decisions made from the SMPA report and its impact on potential process improvements and CSI require longitudinal data and analysis of factors beyond technology constructs, such as top management support, organisation culture and staff morale. This is beyond the scope of this research.

The final outcome evaluation of the SMPA approach is conducted using semi-structured interviews with the process managers at both case organisations. All the process managers are interviewed from each case to evaluate the outcome of the SMPA approach.

The interviews use open-ended questions regarding the outcome of the SMPA approach to collect further evidence to investigate, triangulate, and strengthen the findings from the initial focus group discussion and comparison of the assessment reports. The interviews are scheduled in at least one week gap from the SMPA approach or the manual process assessments so that the interviews may not capture biased opinion based on the fresh experience of the most recent assessment method. The interview questions for outcome evaluation are provided in **Appendix F.4** (p. 270).

Triangulation of the findings from the assessment reports with rich contextual data is especially important due to the novelty of the approach and the unique application of a DSS to this area of research (Jick 1979; Sawyer 2001). Key informants are interviewed and requested to validate their responses three times in some cases over the course of the research to assess the consistency of their responses. For instance the assessment facilitators are able to comment on the SMPA approach on three occasions: firstly during focus group discussion as a survey participant; and then two interview sessions in the role of an assessment facilitator and a process manager. A further benefit of the repeated interviews is to make participants feel comfortable while talking to the researcher (Walsham & Waema 1994).

All interviews are recorded, transcribed and the sections of transcription are emailed where required, to confirm the accuracy of the interview data and give interviewees an option to add/ edit their responses. As part of qualitative data analysis for evaluation, the transcripts are read a number of times by the researcher until a number of themes emerge (Zikmund et al. 2012), guided by the concepts of the software quality in use model. Moreover, expected decision quality and expected decision efficiency (Jarupathirun & Zahedi 2007) are used for evaluation of the SMPA report.

Interview and focus group discussion transcripts from the cases are gathered over a six-month period and coded and analysed for content analysis. Content analysis is a systematic method of extracting a few content categories from the detailed transcribed data based on explicit rules of coding (Krippendorff 2004; Weber 1990). The analyses are compared between respondents and then between two cases to further establish consolidated evaluation findings of the SMPA approach (Eisenhardt 1989b). More details about evaluation data analysis is presented in Chapter 5.

3.5 Justification of the Research Approach

When designing a technological solution for ITSM process assessments, it is imperative to acknowledge the environment within which IT service staff are working. The ITSM environment is one where best practices and standards guide processes (TSO 2011). Therefore introduction of a novel method that also conforms to best practice and standards plays an important role in the acceptance of the artefact. Based on this premise, the SMPA approach is supported by a number of international standards such as ISO/IEC 20000 and ISO/IEC 15504, best practice frameworks such as the ITIL framework, and widely accepted frameworks such as the Balanced Scorecard, SERVQUAL model, and Goal-Question-Metric approach. Incorporation of widely accepted standards and frameworks provides justification of the iterative design and development of the SMPA approach.

Changes brought by an introduction of a new method must be compatible with the existing standards. The ITSM environment has always used technology to enable processes, for example software tools are extensively used for incident management and configuration management (TSO 2011), which means the environment is a sociotechnical one where successful results must come from the complex interaction of people and technology (Mumford 1983). Gregor (2005, p. 4) stated that an information system "concerns the use of artefacts in human-machine systems". This implies that failure of an information system may not necessarily be an error in the technology, but a failure to ensure that there is a fit between the technology and tasks users perform (Zigurs & Buckland 1998). The implication is that the SMPA approach must understand tasks and technologies involved in ITSM process assessments. For example, the DSS used in the SMPA approach must fit within the ITSM process activities to conduct assessments. Hence TTF theory can be justified as a key kernel theory to explain the design process in this research. Moreover the SMPA approach is an intervention in the context of the interaction between IT service staff that impacts how they work. Therefore a case study research based on the software quality in use model for the evaluation of the SMPA approach by process stakeholders can also be justified in this research.

Benbasat and Zmud (1999) stated that one of the problems with IS research is the number of theoretical frameworks that exist for each situation under study. One of the primary research designs chosen for this project is DSR methodology, as discussed in *section 3.3.3*. An advantage of DSR is that it acts to put boundaries around the scope of the artefact development work (Markus, Majchrzak & Gasser 2002). This research is conducted within a complex dynamic context with distinct types of process stakeholders: managers; performers; and external stakeholders of the processes, all of whom would interact with the SMPA approach from different perspectives.

The requirements for the areas of functionality in the SMPA approach are captured from the research opportunities that emerged in the literature review from Chapter 2. It is envisaged that the researcher would play an active part to develop the method at each stage iteratively, and to evaluate the method at two case study organisations. Due to the researcher's involvement in the environment, positivism is not considered as a philosophical lens as the required independence could not be maintained (Neuman 2005). Hence, a participatory research approach with iterative design cycles for the development of the SMPA approach primarily guides the DSR methodology based on a critical realist stance.

After a significant effort in the development of the SMPA approach, this research evaluates the SMPA approach using an interpretative, case study approach. The scope of final evaluation is not extensive since this researcher has to consider time constraints and organisational factors beyond the immediate evaluation findings of the SMPA approach. Ideally, repeated use of the SMPA approach is expected to provide progressive process improvement guidelines that when implemented should improve IT services and lead to the path of CSI in ITSM (similar to Chapter 4, Figure 4.3). However evaluation in this research only considers the usability of the SMPA approach and the SMPA report in terms of expected decision quality on process improvements. In other words, evaluation is focused on immediate findings about the SMPA approach. The actual decisions made to improve processes from the SMPA approach (actual outcome); process improvements based on the SMPA approach recommendations (short-term impacts); and CSI based on improvement of processes from the SMPA approach (long-term impacts) are not evaluated due to the need for longitudinal data on repeated use and impact of the SMPA approach. The limited evaluation effort is justified for this research because of the novelty of the SMPA approach and the significant time spent on its development. A strong support for this situation in DSR can be drawn in this research based on Gregor and Hevner (2013, p. 351): "When the researcher has expended significant effort in developing an artefact in a project, often with much formative testing, the summative (final) testing should not necessarily be expected to be as full or in-depth ...". Consequently only a single iteration of proof-of-concept is presented in this research for artefact summative evaluation. However several design process iterations occur during artefact design and development as formative evaluations and this is explained in detail in Chapter 4.

Construct validity consists of using methods to ensure that there is some confirmation that a construct under study has been captured. Besides formative evaluations during the design process, summative evaluation captures users' perception of usability of the SMPA approach, thereby aiding construct validity (Yin 2009). This research has access to two large public-sector IT organisations. Both organisations are government-run IT service providers; this imposes initial scope delimitation for the evaluation of the artefact in terms of the organisation type. Even though the two organisations differ in size and structure, a common binding element in terms of processes is that both organisations are implementing the ITIL framework albeit possibly at different levels of maturity. The consistent process architecture at both case study organisations suggests that the evaluation results can be applied to general IT service providers that follow the ITIL framework.

Moreover input from three ITSM practitioners (P1-P3), one international standard expert (S1), three academic staff (A1-A3), and validation of the artefact by USQ's IT process managers aid generalisability of the project (Lee 1989). Rowlands (2005) stated that in interpretive research, generalisability is not normally considered but the phenomenon in the context under study should be explained. It is the understanding of the context and people's interactions with the SMPA approach in two IT service organisations that provide rich evaluation data in this research. The researcher therefore uses an interpretive viewpoint for evaluation of the SMPA approach. In this approach it is accepted that information is filtered through the researcher's perceptions and lived experiences (Rowlands 2005). Trauth and Jessup (2000) described using an interpretative lens, by which researchers consider the participant's context, and understanding is allowed to emerge. Therefore qualitative case study evaluation is considered appropriate for this research.

3.5.1 Validity and Reliability

Since this research takes a non-positivist stance, in order to address reliability and validity, the research results can be evaluated in terms of the following quality criteria suggested by Lincoln and Guba (1985) for constructivism research:

(a) *Transferability.* Use of a two-case comparison and evidence of theory compliance.
(b) *Dependability.* Use of DSR methodology for the development and evaluation of the SMPA approach following an iterative design process justified by extant theories.
(c) *Confirmability.* Use of the relevant international standards in the assessment method confirms the activities in the method. Consistency checks are performed using ISO/IEC 15504 guidelines and theoretical propositions following the directives from Yin (2009). Stakeholder checks are provided by input from three ITSM practitioners (P1-P3), three academic staff (A1-A3) and a certified ISO/IEC 15504 expert (S1) during the development of the SMPA approach.
(d) *Credibility.* Use of triangulation to facilitate data validation (O'Donoghue & Punch 2003), theoretical fit, saturation and confirmation of artefact evaluation. Triangulation is ensured with multiple sources of data: focus group discussions with survey participants; semi-structured interviews with assessment facilitators and process managers; comparison of the assessment reports; and feedback from S1 and P1 on the development and use of the SMPA approach.

Even though answers to the quality criteria for validity and reliability of constructivist research discussed above provide reasonable evidence for the justification of the research approach, the justification is not specific enough for the critical realist stance of this research. Therefore, the framework for research quality proposed by Healy and Perry (2000) is used to further corroborate research quality. This framework is chosen because the critical realism qualitative approach adopted in this research fits the requirements of the framework to justify research quality. Six quality criteria used in the framework and how this project fulfilled these criteria are demonstrated in Table 3.4.

In all stages of the research activity –literature review, development and evaluation of the SMPA approach – the central focus is on the research artefact: a novel method proposed as the SMPA approach. This makes the project suitable for DSR as the most practical research method. Moreover, the use of the international standard for software quality in use model, ISO/IEC 25010, ensures that consistent terminologies are used during evaluation data collection and content analysis of qualitative data. This helps assure the validity and reliability of the evaluation phase in the research.

A limitation of the qualitative case study approach is that findings cannot be generalised to an entire population. Therefore, this study acknowledges the limitations of generalising the case study findings (Yin 2009). The intent of this study is therefore to generalise the case study findings for a transparent and efficient ITSM process assessment method and not to a population. Since ultimate demonstration of validity is impossible in case study research (Ryan & Bernard 2003), this research attempts to provide a clear statement of activities recognising the challenges of demonstrating validity in case studies. Validity is enhanced by mitigating the potential for bias using rigorous data collection and analysis in an iterative design process and multi-stage evaluation phases.

Table 3.4 Research Quality Criteria Adapted from Healy and Perry (2000)

Research quality criterion	**Research methods undertaken in this study**
Ontological appropriateness	The research is situated in a socio-technical environment with a complex interaction of people and technology. Therefore, this research is appropriately "world three" (Healy & Perry 2000, p. 120), evaluating interactions of process stakeholders to use a novel method to assess processes that they follow to perform their work.
Contingent validity	The SMPA approach developed in this research is evaluated within the context of the research. This research does not only describe the SMPA approach development but uses theoretical and literal replication to ensure that relevant guidance is obtained from appropriate sources during the SMPA design process. Moreover in-depth questioning of the process managers, rich focus group discussions and an objective comparison of the outcomes of two assessment methods provide rich context of the cases during evaluation.
Multiple perceptions involving triangulation	More than one process manager and process performer are included in the research. Multiple experts from academia, senior IT practitioners and an international standard committee member are involved in the development of the SMPA approach. More than one method of data collection is used with interviewees given the opportunity to verify and/ or correct notes after interpretation by the researcher. Therefore, multiple perceptions including triangulation of several data sources provide strong validity in this research.
Methodological trustworthiness	A rigorous method of design process is followed using kernel theories. A documented chain of case study evidence and description of procedures is provided during evaluation with relevant quotations and matrices to summarise findings.
Analytic generalisation	This research contributes towards developing a design theory as a method for transparent and efficient process assessments that can be consistently repeated to ascertain process improvements leading to CSI. The SMPA approach is confirmed for the discipline of ITSM using two case studies.
Construct validity	The construct validity for this research is tested during the iterative design and development of the SMPA approach by using kernel theories and formative evaluations reviewed by a panel of academia, ITSM practitioners and an international standard expert. This ensures construct validity of the SMPA approach. The maintenance of a chain of evidence and triangulation also aids compliance with this criterion.

Multiple researchers – academics, standard committee members and practitioners – (Table 3.3) and case study participants reviewed the evidence and findings to check for inaccuracies or researcher bias. This increases the validity of the findings while contributing different perspectives on the final artefact. Alternative ITSM process assessment methods proposed from previous academic and industry publications are reviewed to determine research opportunities that could be exploited to ensure the strongest utility and validity for the proposed SMPA approach. The iterative design process further explores different kernel theories that are applied to enhance the utility and validity of the final SMPA approach.

Research objectivity is ensured through triangulation of multiple data sources, constant comparisons and pattern matching between the theories and data (Eisenhardt 1989b; Sawyer 2001; Yin 2009). Objectivity in the research method is ensured through "member checking" – having the informants review the two different assessment reports and highlighting any inaccuracies to ensure the findings followed from the evidence. Objectivity is also enhanced through frequent comparisons and pattern matching between theory and data during the iterative design process.

Content validity is established through the use of previously validated measures such as ISO/IEC 15504 standard process indicators; triangulation of multiple data sources; and theoretical sensitivity of the researchers to the cases using established kernel theories such as the design principles guided by a fit profile from TTF theory. Review of assessment questions by IT service process managers from USQ's IT department and the three stages of summative evaluation of the SMPA approach contribute to the validity of the research method. Reliability is strengthened through the application of a formal case study protocol, maintaining a database of evidence and findings, and comparing results from multiple respondents (Corbin & Strauss 2008; Yin 2009).

3.5.2 Unit of Analysis

An explicit specification of the unit of analysis provides a focus to conduct this research. The unit of analysis for this research is the *method* of ITSM process assessment. It is the existing *methods* that are reviewed to identify research opportunities; a new *method* is proposed as the research artefact; and the proposed *method* is evaluated at two case study organisations. Therefore the activities and review of this research must be focused on the *method*, i.e. the SMPA approach, which is also the central focus in this study being the research artefact.

Moreover, there can be three levels of unit of analysis: organisational, group or individual level (Vessey, Ramesh & Glass 2002). This study is conducted at a *group level*, i.e. the IT service department in an organisation. At TRC ICT, the IT service department is an internal service provider (group) for the regional council. Likewise for CITEC, even though it exists as a separate entity, it is acting as an agency (group) for the Queensland Government Department of Science, Information Technology, Innovation and the Arts (DSITIA) to provide IT services.

3.6 Ethical Considerations

The SMPA approach developed in this research is evaluated by capturing assessment information that asks critical questions about how people perform their work; consequently, ethics clearance is an important prerequisite.

An ethics application for the overall project was submitted to the USQ Human Research Ethics Committee to obtain approval to conduct the research during the early stages of this project. The application explained measures that would be undertaken to conduct this research ethically and in particular informing the research participants about their rights, safety and freedom during research participation. The ethics committee assessed the application and granted full ethics approval on 22 June 2012 after agreeing that the proposal for the research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The ethics approval is included in **Appendix C.1** (p. 244). As provided in the proposal for ethics approval, this research complies with the conditions of the approval and the National Statement (2007).

Consent is sought from participants in a formal research consent form. The consent form states that participation is voluntary and that by filling in the assessment survey and during participation in focus group and/or interviews, the respondent consents to the research. A participant information sheet is also made available during the interviews (**Appendix C.2,** p. 245). The consent process for IT service staff is as follows: an email is sent to the user explaining the project and offering the web link for the online survey. A consent form is part of the survey page, which states that participation was voluntary and that by using the web site, the respondent consents to the research. The consent forms are provided to participants before the focus group discussions and interviews for the use of an audio recorder (**Appendix C.3,** p. 247). The interviewees are made aware that no consequences would arise from declining to participate in the research project, and no incentive or payment to participants is offered.

The information that was collected directly from the research participants is de-identified. However it is necessary to collect information in potentially identifiable forms because face-to-face interviews with the IT service staff are necessary to gain tacit knowledge about the usability of the SMPA approach. It is also necessary to store responses received from the DSS in a non-identifiable form, so that when provided in the assessment report, the comments and responses do not disclose the identity of any individual. The DSS captures the process roles for every respondent based on their unique email addresses. However the email addresses are not stored with the responses in the DSS. Therefore there is no trace of a response associated to any individual. Comments provided in the DSS are manually reviewed by this researcher to ensure that no personal or derogatory information was provided before these comments are included in the final assessment report. Results are reported to the assessment facilitators at each case study organisation. A written transcript of each interview is emailed to the interviewees for their comments, and discussions of results are undertaken by email or phone.

The proposed assessment method differs from standard practice: standard practice is face-to-face discussion about process activities while the SMPA approach uses a DSS with electronic data storage and retrieval. Therefore, information about the participants during the project, and after its completion, is stored on computer files, online database of the DSS platform as well as paper copies of evaluation data. The security of the information during the project is ensured by keeping paper documents locked in the researcher's filing cabinet. Access to these materials is restricted to the researchers involved with the project. Computer files and online database are secure and password protected. Although results of the research are used in academic publications and conferences by the researchers, no identifying details of the participants are disclosed in any publications. It is intended that the research data will be stored for a period of five years from the completion of the project to allow sufficient time to publish results. The disposal of the data will be by shredding the paper materials and permanently deleting the records from the computer files and online database of the DSS platform.

3.7 Chapter Summary

This research is a field study in IS driven by the motivation to develop and evaluate a novel method. The guiding principles of DSR and case study research are used to structure the research design. The goal of this research is to produce a research artefact that would improve the current environment in ITSM process assessments by facilitating the application of international standards using a DSS. Therefore, a DSR methodology is suitable for the development of the artefact.

The research approach includes an iterative design process supported by several kernel theories. The environment within which this research project is conducted is an IT organisation where a novel method to conduct ITSM process assessment is trialled. Therefore, the international standards and guidelines to conduct ITSM process assessments need to be embedded within the logic of the innovative SMPA approach, while making sure that the usability of the SMPA approach and the expected decision quality from using the SMPA report are included for rigorous evaluation.

Several techniques are used to collect data. These include an iterative design process as a form of participatory research; focus group discussions; comparison of reports between manual assessments and the SMPA approach; and semi-structured interviews. Based on the detailed explanation of the research methodology in this chapter, the thesis can proceed with a description of the research artefact, the SMPA approach and its design process in Chapter 4.

Chapter 4. Artefact Design, Development and Demonstration

4.1 Chapter Introduction

Chapter 3 discussed and justified the research design and method. In this chapter, the research method of the iterative design process is explained in more detail to clearly illustrate the artefact in terms of its method description, DSS implementation and demonstration at two case study organisations.

The objective of this chapter is to examine the requirements for a transparent and efficient ITSM process assessment (***task challenges*** from the problem space) and build a corresponding match for the task challenges with the technology functionalities (***technology requirements*** from the solution space). The solution space provides pointers to address the problem space using utility theories (Venable 2006). In this research the utility theory is represented by a fit profile that established a concrete set of design principles in order to develop the SMPA approach. An instantiation of the SMPA approach is represented by implementing a DSS, akin to an IT artefact component of the research artefact. Finally, demonstration of the SMPA approach at two case study organisations is discussed. Figure 4.1 illustrates an overview of this chapter and the structure of the SMPA approach in particular.

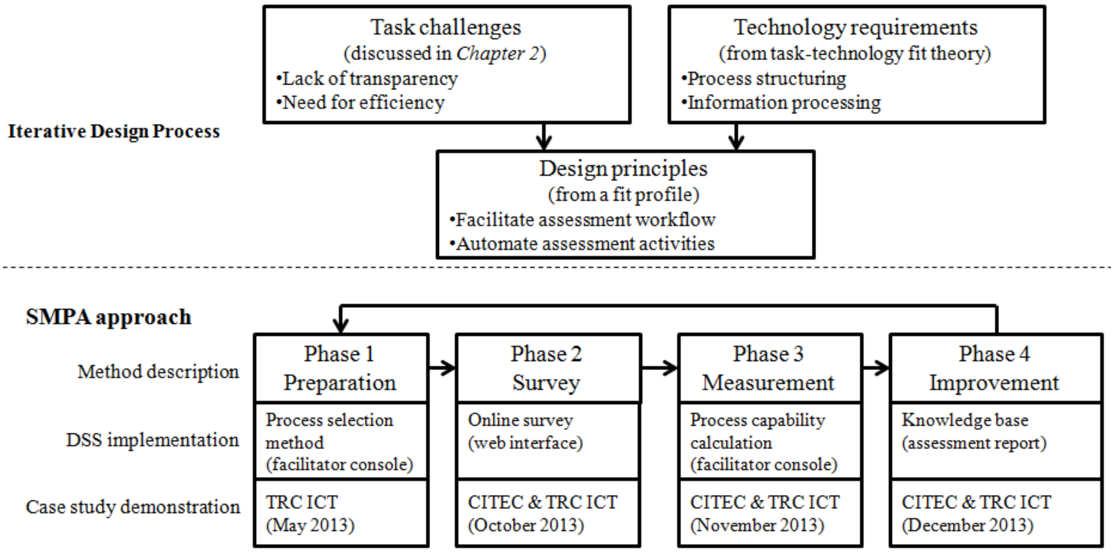

Figure 4.1 Chapter 4 Overview

Chapter 4 has 12 sections. This section is an overview of the chapter. *Section 4.2* provides an overview of the design process that was undertaken to find a solution to the research problem. *Section 4.3* confirms the relevance of the research problem at the two case study organisations. *Section 4.4* discusses technology requirements to support the SMPA approach. *Section 4.5* then presents a fit profile with a set of design principles to guide the development of the SMPA approach. *Section 4.6* explains the structure of the SMPA approach. The next four sections (*sections 4.7, 4.8, 4.9 and 4.10*) provide a detailed explanation of each phase of the SMPA approach in terms of method description and DSS implementation, thereby serving as a proof-of-concept for the artefact (Gregor & Hevner 2013; Peffers et al. 2008). Finally *section 4.11* presents the demonstration of the SMPA approach with an account of each of the SMPA phases implemented at both case study organisations before a conclusion to this chapter in *section 4.12*.

4.2 Iterative Design Process

In the context of the development of the SMPA approach, this section discusses the iterative design process for artefact development. In a DSR project, design can be defined as "a goal-directed thinking process by which problems are analysed, objectives are defined and adjusted, proposals for solutions analysed, objectives are developed and the quality of those solutions is assessed" (Roozenburg & Eekels 1995, p. 3). Hence, DSR can be represented by an iterative design process where the subject is the design and the object is the research artefact. The purpose of explicating design principles is "to conceive the idea for some artefact" (Roozenburg & Eekels 1995, p. 53) as a solution to the identified problems. In this research, a fit profile between the challenges of ITSM process assessments and a technology solution is presented. Subsequently this research follows the advice of Österle et al. (2011, p. 3) regarding the design process, namely, "artefacts should be created through generally accepted methods, be justified as much as possible and be contrasted with solutions already known in science and business".

The research artefact is developed as a method to assess ITSM processes and referred to as the SMPA approach. The SMPA approach, being software-mediated, uses a DSS as an IT artefact to automate the method activities. According to Orlikowski and Iacono (2001), IT artefacts had historically been out of focus in IS research and were treated as static objects. Orlikowski and Iacono (2001) surveyed the extant literature to find how IT artefacts had been perceived in the literature. One of the types of IT artefacts is a "tool view" that sees an artefact as a static technical object (Orlikowski & Iacono 2001). In contrast to the static view of an IT artefact, the IT artefact in this research i.e. the DSS, is seen as a dynamic object. The DSS is positioned as a productivity tool that facilitates transparent ITSM process assessments as well as an information processing tool that enables the collection, analysis and presentation of information regarding ITSM process assessments in an efficient manner. Moreover, the role of the IT artefact is confirmed by evaluating its usability at two IT service organisations. The iterative nature of the artefact design process ensured that the final SMPA approach and its corresponding DSS built after several "build-evaluate" cycles (Hevner 2007) have utility and validity.

4.2.1 Development Workflow of Artefact Components

The four most important artefact components of the SMPA approach are the assessment survey questionnaire, process role allocation to assessment questions, logic for process capability calculation, and a process improvement knowledge base from the ITIL framework.

Records of the four artefact components went through several iterations for industry relevance check (v1.1- v1.99), standards alignment check (v2.1 – v2.99) and academic rigour check (v3.1 – v3.99) during the iterative design process to develop the final research artefact. The iterative design process for the development workflow and the versioning of the records used during the development of the artefact components is illustrated in Figure 4.2.

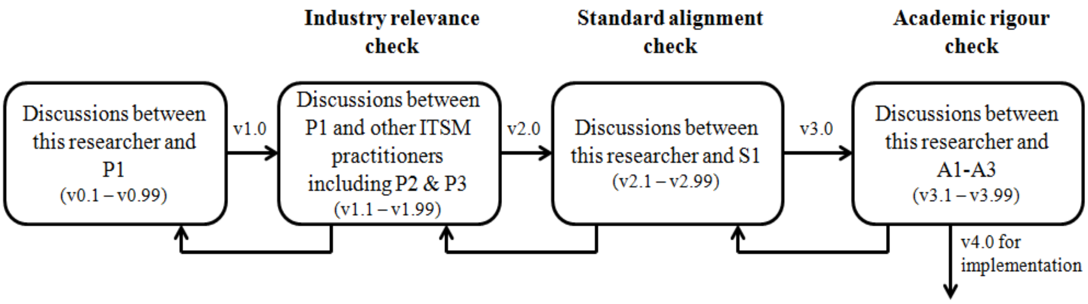

Figure 4.2 Development Workflow of Artefact Components

This researcher adopted a versioning system to carefully track the status of the four work-in-progress artefact components, stored as Microsoft Word documents or Microsoft Excel spreadsheets, used for the development of the SMPA approach. The four records that stored artefact components are described in Table 4.1.

Table 4.1 Artefact Components

Artefact component	Record Type	SMPA Phase	Description
Survey questionnaire	Microsoft Word document	Phase 2 Survey	Lists the standard clause, standard indicator and the question generated from the standard indicator grouped by each process attribute. For PA1.1, the questions are different for each process (base practices). For PA2.1 to PA5.2, the questions are the same for all processes (generic practices).
Role allocation to assessment questions	Microsoft Word document	Phase 2 Survey	Lists the final survey questions along with three checkboxes for the three process roles: process performer, process manager and external process stakeholder. A tick in a checkbox indicates that the question is relevant for the corresponding role.
Logic for process capability calculation	Microsoft Excel Spreadsheet	Phase 3 Measurement	Sample responses for every question related to a particular process attribute are analysed in order to find ways to determine process capability scores and reliability of the responses.
Knowledge base	Microsoft Word document	Phase 4 Improvement	Lists the standard clause, survey question and a knowledge item corresponding to the question. The knowledge items are developed by incorporating specific advice from the ITIL guidelines where applicable.

4.3 Research Problem at Case Study Organisations

A review of existing ITSM process assessment methods identified the lack of transparency and the need for efficiency as important challenges to resolve. This problem has been reviewed in detail in Chapter 2. The research problem was also confirmed during the first meeting at each of the case study organisations. A brief overview of the two case study organisations is provided next before confirming the relevance of the research problem at the case study organisations.

4.3.1 CITEC

CITEC manages a range of information and communication technology (ICT) services for the Queensland State Government in Australia. CITEC is part of the strategic ICT

Division, one of the core business areas of the Department of Science, Information Technology, Innovation and the Arts (DSITIA) for the Queensland Government (DSITIA 2014). CITEC is the lead agency for the Queensland Government's most significant ICT initiatives. The agency also manages a range of shared services for the entire Queensland Government, including a major consolidation of Queensland Government data centres, the implementation of consolidated network connectivity and internet service provision (DSITIA 2014).

CITEC provides ongoing services to individual Queensland Government agencies. According to the official website of CITEC (DSITIA 2014), these services typically include data centre services; infrastructure server management; network services, including a secure and reliable metropolitan area network for government; data storage management; data protection; solutions integration; and support. To deliver effective and innovative services, CITEC draws on a diverse range of technical specialists, including network and server infrastructure specialists, database administrators, program and project managers, business and systems analysts and technology architects (DSITIA 2014).

CITEC operates as both an internal and external service provider with a geographic spread across Australia even though its facilities are located in Brisbane. As confirmed in October 2013, the dominant business cycle for CITEC is a focus on divestment, downsizing and restructure of the organisation, as part of an ongoing restructure of the Queensland Government offices. Based on the information collected as part of the organisation profile and confirmed in October 2013, the approximate number of staff at CITEC was 430 which comprised between 5-10 percent of staff as contractors. It was also confirmed that CITEC was funded as a profit centre with an approximate annual budget of over AUD$100 million. The organisational structure of CITEC was grouped by several ITSM functions; however, most of the significant ITSM processes had a dedicated process owner. The three processes selected for assessment in this research also have process owners. There is a very significant level of awareness of the ITIL framework within CITEC, although less than 25 percent of staff had formal certification. CITEC was using a centralised cloud-based ITSM tool called ServiceNow (ServiceNow 2014) to manage their ITSM operations.

Regarding ITSM process assessments, the assessment facilitator confirmed that process improvement is the major goal of the assessment. The implementation of the SMPA approach was supported at the senior management level at CITEC. Three key drivers underpinning CITEC's participation for the implementation of the SMPA approach were stated by the assessment facilitator: reduce IT service costs; improve customer focus; and reduce stakeholder dissatisfaction with IT service provision.

4.3.2 Toowoomba Regional Council ICT Department

Toowoomba Regional Council (TRC) is the local government authority in the southern Queensland region of Australia (TRC 2013a). In the TRC Annual Report for 2012/13, it is stated that the ICT department of TRC delivered all IT services with in excess of 99.5 percent availability (TRC 2013b). TRC relies on ICT tools to support the delivery of services 24 hours a day, all year round. TRC has identified a number of initiatives in its recently adopted ICT Strategic Plan (TRC 2013b) such as customer contact management; unified communications; eBusiness solutions for improved online accessibility of council information; spatial information services for improved web mapping services; and business architecture improvements including mobile works and self service solutions.

The ICT department of TRC, hereafter referred as TRC ICT, operates as an internal service provider for service provision to TRC staff and residents. TRC ICT is located as part of the service centre in the city of Toowoomba, Queensland. As confirmed in October 2013, the dominant business cycle for TRC ICT is a focus on consolidation, since TRC had undergone an amalgamation of eight smaller regional councils into a single larger entity in 2008. TRC ICT is focused on aggressive organic growth over its current business cycle. Based on the information collected as part of the organisation profile and confirmed in October 2013, the approximate number of staff at TRC ICT was 50. It was also confirmed that TRC ICT was funded as a cost centre to support TRC operations using ICT resources with an approximate annual budget of around AUD$13 million. The organisational structure of TRC ICT was grouped by several ITSM functions; however some of the significant ITSM processes had part-time process owners, including the three processes selected for assessment in this research. There is a very significant level of awareness of the ITIL framework within TRC ICT and almost three quarters of staff had achieved formal ITSM certification. TRC ICT is using a centralised ITSM tool called Cherwell Service Management (Cherwell 2014) to manage its ITSM operations.

Regarding ITSM process assessments, the assessment facilitator confirmed that process improvement is the major goal of the assessment. The implementation of the SMPA approach was supported at the topmost C-level (board) of TRC. Three key drivers underpinning TRC ICT's participation for the implementation of the SMPA approach were stated by the assessment facilitator as: improve IT service quality; improve customer focus; and support greater adaptability of IT service provision.

4.3.3 Challenges in Case Study Organisations

The initial meetings with the nominated assessment facilitators at each case study organisation, coded as C-AF for CITEC and T-AF for TRC ICT, were important to establish rapport as the assessment facilitators are considered the "gate keepers" for the evaluation of the research artefact. An assessment facilitator is expected to coordinate the entire assessment activity by liaising with the process stakeholders for survey participation and to disseminate process improvement recommendations from the assessment report to process managers, as applicable.

An organisation profile was obtained as an input to the SMPA approach in order to understand the assessment context. The organisation profile was recorded as part of a pre-assessment planning form. A template of the form is provided in **Appendix D.1** (p. 248). The two important themes that emerged during the initial meeting with the assessment facilitators were recognised as the apparent task challenges discussed in Chapter 2. These themes were (a) a concern for the lack of a consistent method to assess processes repeatedly; and (b) time and cost requirements for repeated process assessments.

T-AF's concern for the lack of a transparent structure to conduct process assessments was shown by statements such as he "*was looking to have a good technique for assessment from this project*". He was also concerned about how time poor his IT service staff were, however he thought that a likely solution would be to have his staff complete online surveys rather than engage in repeated assessments in person. Another area discussed was the need to prioritise the most critical processes for improvement. When asked if he can provide three processes that he thinks should be assessed in this research, he was not certain how to make this decision. He acknowledged that a decision to select processes to improve would have to be ad-hoc. This was established by statements such as "*we would probably start with problem management [process] since there seems to be issues in that process, but don't ask me why I picked that process … I will probably need to talk to my staff about it*". Developing a structured method to select processes was identified as a research opportunity as discussed in Chapter 2, *section 2.9*.

C-AF stated that a consistent model of measurement must be used for process assessment in the ITSM industry. This was confirmed by statements such as "*everyone understands CMM style maturity scores, but how to use that for process assessment is not so easy. ITIL does not really give enough details about how to conduct process assessments. Is there a standard way of doing this?*" C-AF also shared a document that showed how her organisation is currently conducting process assessment using a risk mitigation approach where shortfalls in each process are mapped to organisational risks. She hoped to improve service processes by experimenting with this approach as "*discussion of risks grabs the attention of senior managers to get some buy-in for improvement*". Another issue was time and cost constraints in that C-AF stated she does not think she can justify high costs for repeated assessments: "*At the end of the day this cost is just to measure, not really to improve … since our business is going through a restructure, high costs of assessments will not be welcome*". She said that management is concerned, not only about the cost of conducting assessments, but also the subsequent resource requirements for process improvement activities. When the prospect of an online survey for assessment and process improvement recommendations using a knowledge base was discussed, C-AF stated that such an approach "*appears to be ideally suited*" to allow process assessments to work well.

Review of the meeting notes from the first meeting assisted this research by bringing to light areas of interest of the assessment facilitators, and helped to set boundaries and objectives for the development of the SMPA approach. The meetings with assessment facilitators confirmed that the project objectives were in line with the challenges in the two case study organisations. Consequently the meetings were able to generate further interest in this research project.

4.4 Technology Requirements

The existing challenges of the lack of transparency and need for efficiency in the task of process assessment have been discussed in Chapter 2. The task of ITSM process assessment can be grouped as a typical "decision task" since process assessments are conducted to make informed decisions to improve processes continually. According to TTF theory, technology requirements to address the challenges of a decision task must focus on "information processing" and "process structuring" dimensions of technology for enhanced performance (Zigurs & Buckland 1998). In this project, the term "technology requirements" is used rather than "technology dimensions" as explained originally in the theory. This is because existing technology dimensions were not evaluated for a fit but a new technology solution that fits task challenges to technology requirements was developed. The two technology requirements articulated from TTF theory in order to develop the SMPA approach are discussed next.

4.4.1 Process Structuring

According to TTF theory, process structuring refers to “any aspect of the technology that supports, enhances, or defines the process by which groups interact” (Zigurs & Buckland 1998, p. 319). In the context of this research, facilitation of ITSM process assessment activities involving all process stakeholders represents process structuring. The SMPA approach must define the assessment process workflow by which the entire procedure is conducted transparently as explicitly documented in the standard (ISO/IEC 2004b). Assessment workflow steps have been proposed in the TIPA framework to define a structure in the assessment activities: Definition; Preparation; Assessment; Analysis; Results Presentation; and Closure phases (Barafort et al. 2009). These steps align well with the SMPA approach activities, however assessment data collection, analysis and result presentation are automated with the use of a DSS.

The technology requirement of process structuring can lead to the development of the SMPA approach that can facilitate the entire assessment process in a transparent manner. Transparency is achieved with the use of a DSS since the DSS can provide comprehensive coverage of all questions related to the standard using online surveys. The approach of asking questions directly to the assessment participants and allowing the DSS to objectively calculate process capabilities based on the survey responses promotes transparency. Moreover, the assessment report includes process improvement recommendations based on the ITIL framework that are stored in the knowledge base of the DSS, thereby promoting transparency since the recommendations are based on the questions that align with the process assessment model of the standard.

4.4.2 Information Processing

According to TTF theory, the information processing dimension is the capability of the technology to “gather, share, aggregate, structure or evaluate information” (Zigurs & Buckland 1998, p. 321). According to this dimension applied in the research, the ability to automate activities of process assessment is considered as the information processing requirement for the development of the SMPA approach. The steps of assessment data collection and validation, process capability ratings and reporting of the assessment results require gathering, aggregating, evaluating and finally presenting information as listed in Clause 4.2.2 of ISO/IEC 15504-2 (ISO/IEC 2004b).

An efficient information processing capability is an important requirement for the SMPA approach. Efficiency is achieved by the use of online surveys instead of multiple assessment interviews for data collection, and the generation of process improvement recommendations extracted from the knowledge base in the DSS. Process assessments using a DSS may enable cost-effective and repeatable assessments so that the organisations can spend their time and resources on process improvement activities rather than to conduct assessments.

4.5 Design Principles

After a careful analysis of the task challenges discussed in Chapter 2 and the technology requirements stated in *section 4.4*, a fit profile considering the task challenges and technology requirements is established to articulate artefact design and development. In this research, the fit profile provided design principles for the SMPA approach development. 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. In this research, the fit profile is not designed to evaluate the performance of an existing technology. Instead, the fit profile provides design principles for the development of the SMPA approach. The fit profile as shown in Table 4.2 answers the first research question (RQ1): "How can a software-mediated process assessment (SMPA) approach be developed for transparent and efficient process assessments in IT service management?" The two design principles are discussed in detail next.

Table 4.2 Fit Profile for Design Principles to Develop the SMPA Approach

ITSM process assessment (Task challenge)	Decision support system (Technology requirement)	Design principle
Lack of transparency	Process structuring	Facilitate assessment workflow
Need for efficiency	Information processing	Automate assessment activities

4.5.1 Facilitate Assessment Workflow

Emergent from the task challenge of the *lack of transparency* and the technology requirement of *process structuring*, facilitating a consistent workflow for ITSM process assessment is crucial for the success of an assessment project. It would be worthwhile to establish an ITSM process assessment method that uses the ISO/IEC 15504 standard as a matter of consistency and in order to establish norms for a transparent method. The SMPA approach has been conceptualised with this design principle and adopts a goal-based measurement of process capabilities for ITSM process assessments.

In order to facilitate assessment workflow to address transparency issues, alignment with the international standard for process assessment is critical while developing the SMPA approach. A thorough review of the normative reference of the international standard for process assessment (ISO/IEC 2004b), the PRM (ISO/IEC 2010) and the PAM for ITSM (ISO/IEC 2012b) was conducted to develop the SMPA approach. Likewise, a top-down approach in ITSM process assessment ensured that the measurement follows a transparent workflow of assessment activities driven by the goals of each process attribute specified in the standard. This method is guided by the Goal-Question-Metric (GQM) approach (Basili, Caldiera & Rombach 1994) which is a widely used measurement system in the field of software engineering. The concept of GQM approach defines a process measurement model on three levels: goal (conceptual level); question (operational level); and metric (quantitative level) (Van Solingen et al. 2002).

The GQM approach is a *de facto* standard for the definition of software measurement frameworks (Berander & Jönsson 2006). This approach has been extensively applied in the software industry. However use of this approach to develop the SMPA approach in ITSM is novel. In this research, the GQM approach is applied to define the assessment workflow in the SMPA approach. The application of an objective GQM approach for assessment workflow is the key facilitator for a transparent process assessment. The GQM approach to facilitate assessment workflow is further explained in the following three sub-sections.

4.5.1.1 Goal Specification

As part of the planning for the assessment, it is important to capture the profile of the organisation that is being assessed. It is also important for organisations to carefully scope process assessments in terms of the maximum capability level to be assessed and the number of processes to be assessed. A rigorous method to select critical processes to assess and improve is suggested as part of the assessment workflow in planning. After defining the scope of process assessment, survey participants are listed and allocated to their corresponding roles for each process being assessed.

The international standard for ITSM includes a PRM where each process is defined in terms of its purpose and outcomes (ISO/IEC 2010). Attainment of the process purpose by meeting the outcomes defines achievement of process performance (CL1) in the assessment. The goals of assessment of higher capability levels (CL2 to CL5) are specified in the process attributes provided in the standard (ISO/IEC 2012b). These references are used to develop goal statements in the assessment workflow based on the GQM approach. The goal-driven assessment planning drives the SMPA approach and defines the “goal” component of the assessment workflow.

4.5.1.2 Question Generation

The PAM for ITSM (ISO/IEC 2012b) comprises a set of base practices to fulfil the process outcomes and a set of generic practices for process management (CL2), standardisation (CL3), quantitative measurement (CL4) and innovation (CL5) of process capability. These practices are used as assessment indicators by an assessor in a formal assessment.

In the context of this research, the emphasis is to provide information that can drive improvement of ITSM processes. Therefore the standard practices are transformed into a set of assessment questions for the four ITSM processes. All the process assessment questions generated for the assessment survey are based on the PAM of the international standard. The development of standards-based assessment questions defines the “question” component of the assessment workflow.

4.5.1.3 Metric Calculation

Every question is answered using the NPLF scale: “Not” (N); “Partially” (P); “Largely” (L); “Fully” (F) and “Not Applicable” (NA) as defined in the measurement framework of ISO/IEC 15504 (ISO/IEC 2004b). The NPLF scale is directly transformed into a set of answer options for each question so that every choice for a question relates to a scale for measurement of process capability. Hence the NPLF scale is converted to a measurable variable to determine process capability. This defines the “metric” component of the assessment workflow. Moreover, this metric also enables generation of the relevant process improvement recommendations based on the process capability scores.

The process capability rating provides a metric based on the responses of the survey participants. Rather than the assessment team making a subjective choice of the indicator rating, the SMPA approach objectively measures feedback from the relevant process stakeholders based on their collective responses to the assessment questions.

The GQM approach is applied as the design principle for assessment workflow in the SMPA approach. The GQM approach provided the structure to undertake the online survey, process capability determination and process improvement recommendations. This structure is designed to achieve transparency in the conduct of ITSM process assessments.

4.5.2 Automate Assessment Activities

Based on the task challenge of the *need for efficiency* and the technology requirement of *information processing*, automation of the activities of ITSM process assessment is a design principle that is adopted by developing a DSS for the SMPA approach. This design principle is necessary for cost-effective and repeatable process assessments. The lack of efficiency in the existing methods is based on the time and resource requirements to organise process assessments. The SMPA approach has the potential to address this challenge since the use of a DSS can automate several assessment activities including assessment data collection, analysis and reporting. Automation is achieved for all stages of process assessment activities as discussed next.

4.5.2.1 Assessment Data Collection

The DSS in the SMPA approach allocates assessment questions to the survey participants based on three process roles: process performers; process managers; and external process stakeholders. The three process roles apply well to ITSM processes (Barafort et al. 2009). The DSS accumulates responses from all the relevant process stakeholders using an online survey. Every question also features a free text comment box to capture contextual data that can be analysed to validate responses and provide specific recommendations. 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, de Ruyter & Wetzels 2006). Details regarding assessment data collection are discussed in Phase 2 Survey of the SMPA approach in *section 4.8*.

4.5.2.2 Process Capability Determination

The DSS determines a final process attribute score for each process. This is done by calculating the mean value of all the responses for every process attribute.

The coefficient of variation (*CoV*) of all the responses is also computed by the DSS:

$CoV_x = \frac{\delta_x}{\bar{x}}$, where CoV_x is the coefficient of variation, δ_x is the standard deviation and $\bar{x}$ is the mean value of *x* responses for a particular process attribute score.

CoV is used to determine the reliability of the process score based on the dispersion of the responses. The mean and the *CoV* are simple statistical measures to understand what the critical mass of assessment respondents think about the processes being assessed. Details regarding process capability determination are discussed in Phase 3 Measurement of the SMPA approach in *section 4.9*.

4.5.2.3 Assessment Reporting

The DSS in the SMPA approach is not just a stand-alone survey engine. The DSS also embeds a knowledge base that stores recommendations for process improvements tied to every assessment question. Using the knowledge base developed from best practice guidelines for process improvements in ITSM, i.e. the ITIL framework, the DSS performs gap analysis based on the collected response metrics and produces a report with specific process improvement recommendations. The knowledge base with recommendation items is developed at the question level for four ITSM processes in this research. For every question where the final process capability score is either “partially” (P) or “not” (N), i.e. there is an element of risk in the process capability relating to the assessment question, a knowledge item associated with the question is extracted from the knowledge base. When the online survey is completed, the accumulated knowledge items are compiled to generate a final assessment report with process improvement recommendations. Details regarding assessment reporting are discussed in Phase 4 Improvement in s*ection 4.10*.

In summary, the propositions offered by the two design principles to facilitate assessment workflow using the ISO/IEC 15504 standard and to automate assessment activities using a DSS provide a framework to construct the SMPA approach. The structure of the SMPA approach is described in the next section.

4.6 Structure of the SMPA Approach

In this section, each of the four phases of the SMPA approach is described, including the theoretical justification of the activities in each phase. This is followed by an explanation of how the DSS was implemented to support the SMPA approach.

Table 4.3 presents a summary of the research artefact developed during this research.

Table 4.3 The Software-mediated Process Assessment (SMPA) approach

Phase	**Assessment area**	**Process Assessment guideline**	**ITSM Process Assessment workflow**
Phase 1 Preparation	Planning (input)	Define assessment goals, context and scope	Record assessment information, including: • Organisation profile • Assessment goals • Processes to assess • Assessment participants and their process roles (process manager, process performer or external process stakeholder)
Phase 2 Survey	Data collection	Collect responses to explicit assessment questions directly from participants	Conduct online surveys of assessment questions based on the process indicators from the ISO/IEC 15504 PAM for ITSM.
Phase 3 Measurement	Data analysis	Analyse responses transparently to measure process capability	Calculate assessment profiles using the guidelines from ISO/IEC 15504-2.
Phase 4 Improvement	Reporting (output)	Use assessment results to guide process improvement	Generate process improvement recommendations based on the guidelines from the ITIL framework and compile an assessment report.

The SMPA approach prescribes four phases to conduct ITSM process assessments. The first phase is preparation. In the first phase, information about organisation profile, processes to assess and assessment participants along with their process roles is captured using the DSS. The first phase represents the input to the SMPA approach as it demonstrates preparation to conduct assessments. The second and third phases survey the process stakeholders according to the ISO/IEC 15504 standard PAM and then measure process capability based on the survey responses. The final phase delivers the outcome by generating an assessment report that recommends process improvements for CSI in ITSM. Based on the SMPA approach presented in Table 4.3, Figure 4.3 represents the application of the SMPA approach in ITSM.

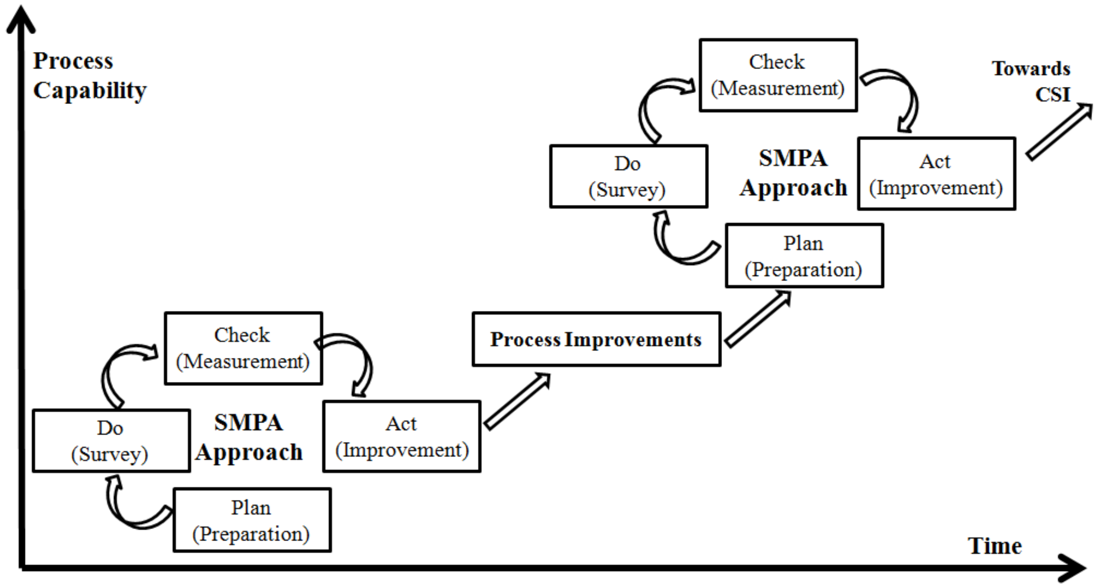

Figure 4.3 Plan-Do-Check-Act Cycle of the SMPA Approach

Figure 4.3 also demonstrates the application of the PDCA cycle (Moen & Norman 2006; Walton 1988) using the SMPA approach by incorporating the four phases into an ongoing process improvement cycle for CSI. Since the SMPA approach is built to address the challenges of the lack of transparency and need for efficiency, the PDCA cycles of the SMPA approach are designed to be coherent with each other. With the application of the SMPA approach, organisations can focus on the process improvement efforts rather than being concerned about the method and cost of repeated process assessments. The next section discusses how DSS technology supports the SMPA approach to facilitate and automate process assessment activities prescribed by the SMPA approach.

4.6.1 DSS for the SMPA Approach

To ensure that the SMPA approach captures all the information that an assessor typically considers to be required for process assessment, a DSS was developed to facilitate the entire assessment workflow and automate assessment activities. The DSS represents a working IT artefact that supports the four phases of the SMPA approach. The DSS also abstracts the important SMPA phases of (3) measurement and (4) improvement by automating process capability determination and generation of the assessment report. Therefore an assessment facilitator is not required to have expertise in the domain of process assessment or ITIL in order to facilitate the SMPA approach.

The requirements for the DSS were developed by using design principles that fit technology requirements to task challenges of ITSM process assessment. Table 4.4

presents the four support areas of the DSS that correspond to the four phases in the SMPA approach and provides expected results from using the DSS.

Table 4.4 DSS support areas in the SMPA approach

SMPA approach	**DSS support area**	**Expected result**
Phase 1 Preparation	Process selection method	**Service managers:** decision support to select critical processes to improve **Process stakeholders:** have a say in the processes that need improvement
Phase 2 Survey	Online survey	**Assessment facilitator:** a consistent goal-based measurement model to ask questions about process capability **Survey participants:** convenient medium to respond to their understanding of the processes that they currently follow
Phase 3 Measurement	Process capability rating	**Assessment facilitator:** a transparent method to determine process capability score **Service managers**: trend analysis of how the scores have progressed in repeated assessments to evaluate benefits of process improvements
Phase 4 Improvement	Knowledge base	**Process managers**: list of process improvement recommendations based on ITIL in an assessment report

Figure 4.4 illustrates the structure of the DSS. It demonstrates the four areas of DSS support and how the DSS facilitates information flow across the four phases of the SMPA approach.

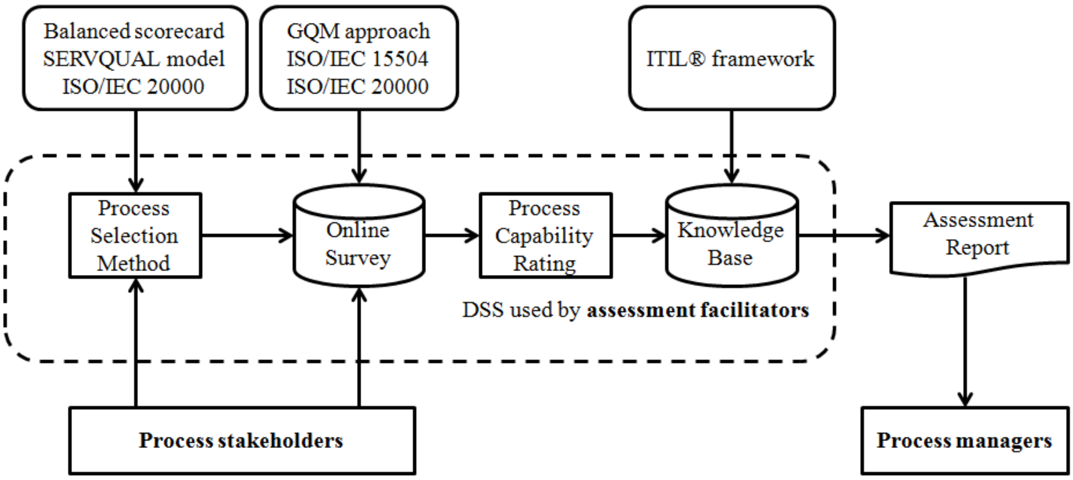

Figure 4.4 Structure of the DSS for the SMPA Approach

As a response to the first research opportunity to develop a method to select critical processes for assessment and improvement, the processes listed in ISO/IEC 20000 (ISO/IEC 2011b) were considered for the initial list. The process selection method was guided by the principles of the Balanced Scorecard (Kaplan & Norton 1992) and the SERVQUAL model (Parasuraman, Zeithaml & Berry 1985). With the input from the process stakeholders and operated by an assessment facilitator, the DSS assists in the selection of critical processes to improve based on business drivers and stakeholders' service gap perceptions.

For the second research opportunity, the DSS can be developed to collect and analyse assessment data before providing relevant process improvement recommendations. Assessment questions derived from the PAM of the ISO/IEC 15504 standard (ISO/IEC 2012b) and structured based on the GQM approach (Basili, Caldiera & Rombach 1994) were formulated. The questions were then loaded into an online survey for the process stakeholders to complete. After collecting all survey responses, the DSS calculates process capability scores and produces an assessment profile for each process guided by the measurement framework of the ISO/IEC 15504 standard (ISO/IEC 2004b). Finally, based on the assessment profile, the DSS identifies areas of risk in the processes where the process scores are low. The DSS then provides process managers with an assessment report with process improvement recommendations drawn from a knowledge base of ITIL guidelines.

Three types of users of the DSS are listed in Table 4.5 along with their typical role descriptions.

Table 4.5 Users of the DSS in the SMPA Approach

User Type	Function	Typical role description
Process Stakeholder	Input	Engages in process selection method and completes online assessment survey
Assessment Facilitator	Processing	Facilitates the entire SMPA approach
Process Manager	Output	Receives assessment report and makes decision on process improvements based on the report

Process stakeholders provide input to the SMPA approach since they are the source of the assessment data collected from the online survey. One of the most important factors in the design of the SMPA approach is the role of the assessment facilitator. During process assessment, assessment facilitators are expected to have a clear understanding of the assessment workflow and operate the DSS in order to facilitate the entire SMPA approach workflow. Finally process managers represent the third type of DSS users who receive the output of the DSS in the form of an assessment report that enables them to make decisions on process improvements. In order to engage all the users in the SMPA approach, two interfaces of the DSS provided by the research partner were utilised in this research. Table 4.6 lists and describes the DSS interfaces.

Table 4.6 Interfaces of the DSS in the SMPA approach

Interface	Intended user	Description
Facilitator Console (Microsoft Windows interface)	Assessment facilitator	Facilitate and automate assessment workflow during the entire SMPA approach phases
Online Survey (Web interface)	Process Stakeholder	Login and answer assessment questions online by selecting one of the answer options, and providing comments (optional).

The DSS provides a console to facilitate and automate assessment activities for assessment facilitators. Therefore, the DSS needs to feel like an instrument that allows assessment facilitators to easily step through the phases of preparation, survey, measurement and improvement activities in the SMPA approach. Moreover, the DSS needs to provide quality information in an easy-to-assimilate assessment report using a knowledge base.

The typical workflow for a facilitator during an assessment is illustrated in Figure 4.5. The straight lines suggest typical activities performed by the facilitator using the console whereas the dotted lines represent background activities automated by the DSS.

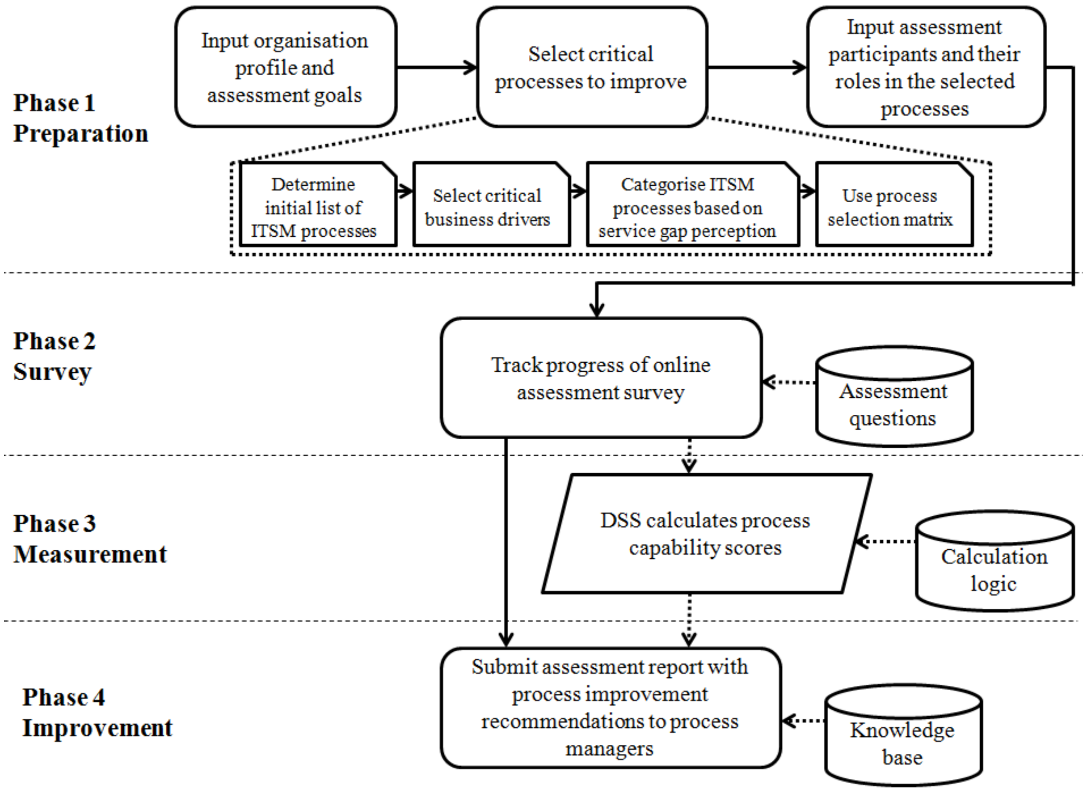

Figure 4.5 Typical Workflow for an Assessment Facilitator Using DSS

Similarly for all process stakeholders, the DSS enables an online survey to input assessment data. To achieve user satisfaction the online survey had to look and feel easy to use to transition between clear sets of assessment questions that were logically grouped. The typical workflow for a process stakeholder as a survey participant during an online survey is illustrated in Figure 4.6. The straight lines suggest typical activities performed by the survey participant using the survey interface whereas the dotted lines with arrow heads represent background activities automated by the DSS.

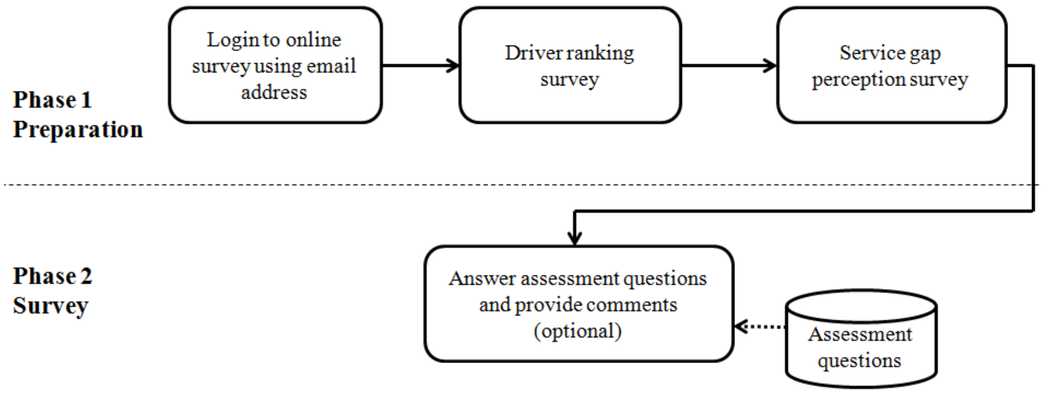

Figure 4.6 Typical Workflow for a Survey Respondent Using DSS

After an overview of the SMPA approach and the structure of the DSS used to facilitate and automate ITSM process assessment, the next four sections provide a detailed description of the four phases of the SMPA approach. Two levels of detail for each phase of the SMPA approach, method description and DSS implementation, discussed in the following sections serve as illustration and proof-of-concept for the SMPA approach (Gregor & Hevner 2013; Peffers et al. 2008).

4.7 Phase 1. Preparation

The international standard for process assessment, ISO/IEC 15504 (ISO/IEC 2004b) defines four key scoping dimensions to prepare for a standard process assessment exercise: (a) organisation context for assessment; (b) organisation unit to be assessed; (c) highest capability level to assess; and (d) processes to assess. Since the first three dimensions largely depend on the specific organisational context, an organisation profile form was generated to capture this information for the SMPA approach. For the fourth dimension however, the SMPA approach incorporates a general method to select processes to assess and improve. The process selection method is developed as a response to one of the research opportunities identified in Chapter 2, *section 2.9.*

4.7.1 Organisation Profile and Assessment Goals

Method description. In this step, information about the first three scoping dimensions of process assessment, i.e. organisation context, assessment goals and maximum capability level to assess are captured in a form. **Appendix D.1** (p. 248) provides a template of the pre-assessment planning form that is required to obtain information regarding the organisation profile, goal and scope of the assessment.

DSS implementation. The DSS implemented the form in the facilitator console, thereby enabling an assessment facilitator to record information about the organisation being assessed and the goals of the process assessment. **Appendix E.1** (p. 253) shows a screenshot from the DSS that represents the pre-assessment planning form.

4.7.2 Process Selection

In this section, each step of the process selection method is described including the theoretical justification of the step, followed by how the step was implemented using the DSS. The process selection method was already in place in the DSS platform developed by the research partner AP. In this research, the method was enhanced after several iterations of revisions in collaboration with P1-P3 and A1-A3. Subsequently changes were made in the method to reflect the improved for the process selection choice.

Table 4.7 provides an overview of the revised process selection method developed in this research. The first step is to determine an initial list of ITSM processes under consideration for improvement. This represents the input to the process selection method. The second and third steps follow an exercise to select critical business drivers and the perceptions of service gaps by process stakeholders simultaneously. The final step delivers the results by producing a process selection matrix that represents the critical processes for improvement.

Table 4.7 Process selection method in the SMPA approach

Step	Function	Description
(1) Determine initial list of ITSM processes	Input	Provide a list of all processes that are implemented in the organisation with clearly defined purposes and expected outcomes
(2) Select critical business drivers	Business value of processes	Select a key subset of business drivers across different sections of the Balanced Scorecard for the organisation. Business drivers are linked to ITSM processes with a score based on their alignment. This determines how processes rank based on an organisation's business objectives.
(3) Categorise processes based on service gap perception	Perceived importance of processes	Conduct a service gap perception survey of concerned stakeholders based on the SERVQUAL model and present the survey findings to facilitate discussions about service gaps. Following these discussions, process stakeholders agree on categorising ITSM processes based on their need for improvement.
(4) Produce a process selection matrix	Output	According to process scores from steps (2) and (3), a process selection matrix is presented to service managers to recommend which processes should be considered for improvement.

Based on the process selection method presented in Table 4.7, Figure 4.7 follows the Analytic Hierarchy Process (AHP) analysis to structure the method by decomposing the decision task into a hierarchy (Saaty 1990).

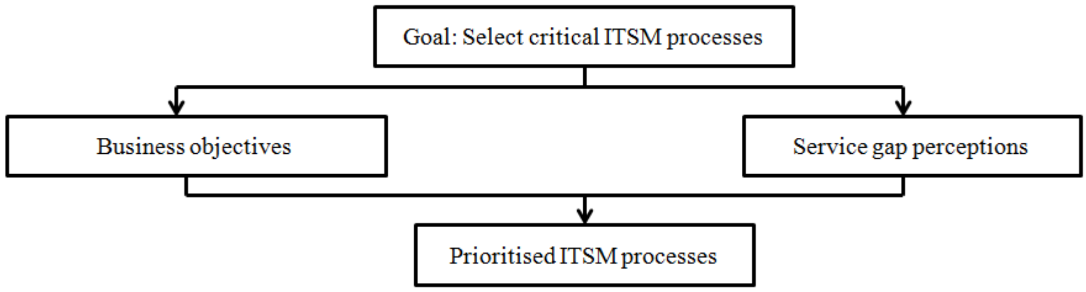

Figure 4.7 A Model for Process Selection Method Based on Saaty (1990)

In the following sections, a detailed explanation of the steps involved in terms of method description and DSS implementation is provided.

4.7.2.1 Determine Initial List of ITSM Processes

Method description. The list of ITSM processes that are considered for improvement provides input to the process selection method. All processes should be well established and implemented in an organisation before being considered for ongoing improvement. Different IT organisations may have different processes under consideration for improvement. However, useful information for initial consideration of processes can be obtained from the PRM of the ISO/IEC 20000 standard (ISO/IEC 2010) since this model clearly specifies the purpose and expected outcomes of each process.

DSS implementation. The process selection module of the DSS presents all relevant ITSM processes for the process stakeholders to consider for improvement. For this research, 12 ITSM processes from ISO/IEC 20000 were considered. There were two selection criteria for the initial list of processes: (a) availability of the PRM from ISO/IEC 20000; and (b) direct alignment between ISO/IEC 20000 and ITIL processes based on the ISO/IEC 20000-ITIL bridge published by Kempter and Kempter (2013). Table 4.8 lists the initial ITSM processes along with their purpose as specified in the ISO/IEC 20000 standard.

4.7.2.2 Select Critical Business Drivers

Method description. After the relevant ITSM processes are identified, critical business drivers can be determined according to the dimensions of the Balanced Scorecard (Kaplan & Norton 1992). It is important to select critical business drivers rather than processes directly because most managers struggle to comprehend their business in terms of processes (Davenport & Short 1990). While other frameworks such as value chain analysis, critical success factors and risk assessments can also determine important processes for business, the choice of the Balanced Scorecard presents a more stable analysis of KPIs for an organisation at a strategic level from four perspectives: financial; customer; internal business; and innovation and growth (Kaplan & Norton 1992). The concept of Balanced Scorecard is well accepted in business as a core management tool (Kaplan & Norton 2001).

Table 4.8 Initial list of ISO/IEC 20000 Processes for Consideration

Process (from ISO/IEC 20000)	**Purpose (specified in ISO/IEC 20000-4)**
6.1 Service level Management (SLM)	Ensure that agreed service level targets for each customer are met
6.3 Service Continuity and Availability Management (SCAM)	Ensure that agreed service levels will be met in foreseeable circumstances
6.4 Budgeting and Accounting for IT Services (BAS)	Budget and account for service provision
6.5 Capacity Management (CaM)	Ensure that the service provider has service capacity to meet current and future agreed requirements
6.6 Information Security Management (ISM)	Manage information security at an agreed level of security within all service management activities
7.1 Business Relationship Management (BRM)	Identify and manage customer needs and expectations
7.2 Supplier Management (SM)	Ensure supplier services are integrated into service delivery to meet the agreed requirements
8.1 Incident and Service Request Management (ISRM)	Restore agreed service and fulfill service requests within agreed service levels
8.2 Problem Management (PM)	Minimize service disruption
9.1 Configuration Management (CoM)	Establish and maintain the integrity of all identified service components
9.2 Change Management (ChM)	Ensure all changes are assessed, approved, implemented and reviewed in a controlled manner
9.3 Release and deployment management (RDM)	Deploy releases into the live environment in a controlled manner

The customer dimension of the Balanced Scorecard can be split into internal and external customers to recognise that IT service providers deliver both internal- and external-facing services (TSO 2011). This provides a finer granularity in the identification of the typical business drivers. Before deriving the 25 business drivers, two relevant Balanced Scorecard frameworks that were aligned to IT governance

(Saull 2000; Van Grembergen & De Haes 2005) were reviewed. In consultation with P1, the business drivers were then contextualised to the ITSM discipline. A list of 25 business drivers that were identified from the five dimensions of the Balanced Scorecard is illustrated in Figure 4.8.

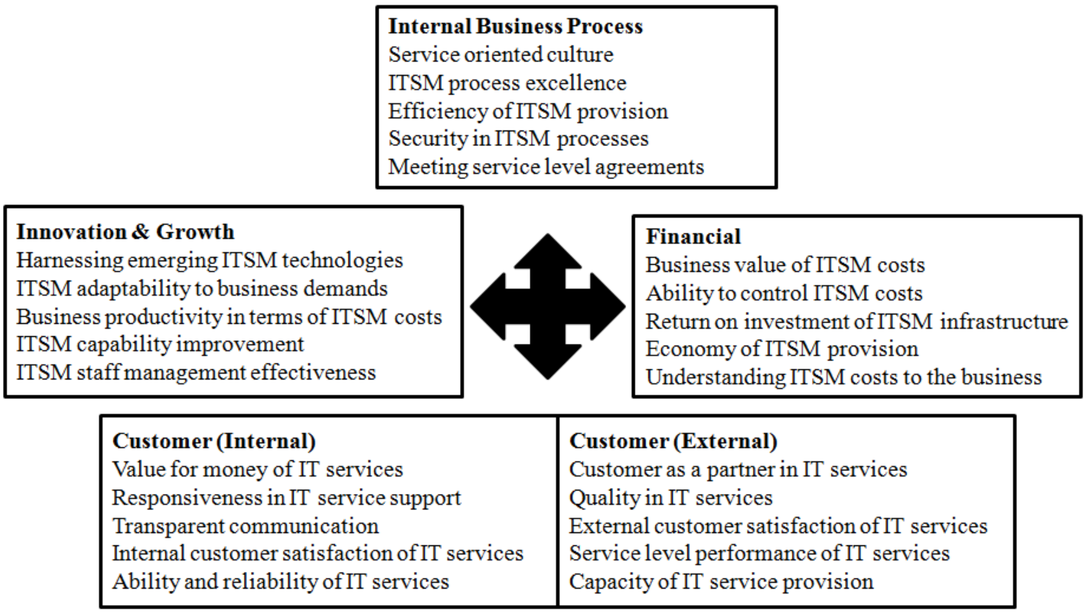

Figure 4.8 ITSM Business Drivers Based on the Balanced Scorecard (Kaplan & Norton 1992)

Using the ITSM concept that processes support the provision of services and these services in turn support the business objectives, business drivers were associated with ITSM processes following instructions as listed in to link the impact of processes to business goals – thus providing a measure to determine which processes are more important.

A matrix that relates each of the drivers to ITSM processes was constructed. This was done by cross referencing 12 ISO/IEC 20000 processes (ISO/IEC 2010) with each of the 25 drivers using an alignment score. To calculate the alignment rating, a five-point scale based on the process measurement framework defined in the ISO/IEC 15504 standard was used. The ratings are defined in Table 4.9.

In order to develop the process-business driver alignment matrix, a set of instructions was developed to code the alignment rating of ITSM processes to business drivers. The coding instructions, as specified in Table 4.9, were then agreed for each process on each business driver and presented to five expert ITSM consultants with ITIL Expert qualifications. The experts coded the alignment ratings using a Delphi technique in three rounds. A Delphi study is relevant in this context since it is considered a democratic and scientific method for development and evaluation of conceptual models (Moody 2005).

The final ITSM process-business driver alignment matrix developed as an outcome of the Delphi study is presented in **Appendix D.3** (p. 250). Activities in an organisation may be grouped into different processes and such choices may be subjective. Interfaces and interactions between different processes complicate alignment of processes with specific business drivers. However, the explicit process list from the ISO/IEC 20000 standard was used in this research. An ITSM organisation that follows ITIL or

ISO/IEC 20000 guidelines in terms of process definition and implementation can apply the process alignment with business drivers as used in this research.

Table 4.9 Rating Scale for Alignment of Each ITSM Process to Business Drivers

Process alignment score	**Description**	**Coding instruction**
4 (Fully)	Process is critical for the business driver	If the overall purpose and ALL expected outcomes of a process can be clearly discerned with the business driver
3 (Largely)	Process is largely important for the business driver	If the overall purpose and more than 50% of all expected outcomes of a process can be discerned with the business driver
2 (Partially)	Process is partially important for the business driver	If the overall purpose and at least some (more than 15%) of the expected outcomes of a process align with the business driver
1 (Not)	Process is marginally or not important for the business driver	If the overall purpose of a process does not well align with the business driver; however at least one expected outcome of the process aligns with the business driver
0 (Not Applicable)	Process is not relevant for the business driver	If there are no expected outcomes of a process that aligns in any way with the business driver

DSS implementation. The DSS loads all 25 business drivers and provides an interface to rank the business drivers by key ITSM process stakeholders in three groups, viz. customers (service beneficiaries), IT service managers and IT service employees. The driver ranking exercise comprises two activities:

- shortlist ten most important business drivers from the 25 business drivers by ranking the top two drivers from each of the five dimensions of the Balanced Scorecard; and
- pairwise comparison to compare the ten shortlisted business drivers against each other and arrive at the top four business drivers.

The rationale behind using the pairwise comparison was to apply adequate rigour in choosing the final four business drivers by comparing each of the shortlisted ten business drivers in pairs. Such a structured pairwise comparison technique can handle complex group decision-making and is widely used in the scientific study of preferences based on AHP (Saaty 1990).

After the selection of the top four business drivers based on consensus, the process selection module in the DSS calculates a score for each ITSM process by summing their alignment ratings (4 – Fully to 0 – Not Applicable) based on the alignment matrix (**Appendix D.3,** p. 250). This score is called the "Business driver score" of the process. The maximum score that an ITSM process can achieve is 16 (4-Fully aligned with all four business drivers) and the minimum score is zero (not Applicable to all four drivers). This score provides a metric to demonstrate the importance of ITSM processes to business.

4.7.2.3 Categorise Processes based on Service Gap Perception

Method description. In this step, perceptions of service gaps in IT service delivery across all process stakeholders are identified and presented in order to facilitate discussions to categorise processes based on the need for improvement. Even though the customer perspective of the Balanced Scorecard produced business drivers to align ITSM processes to business goals, the approach ignored the perceptions of the key process stakeholders of IT services. In order to query process stakeholders in regards to their perceptions of quality service, a service gap perception survey based on the SERVQUAL model proposed by Parasuraman, Zeithaml and Berry (1985) is used. **Appendix A** (p. 242) presents an overview of the SERVQUAL model.

The objective of using the SERVQUAL model in this research is for gap analysis to determine service gap perception factors that shape stakeholders' understanding of their role and preferences in executing ITSM processes. Understanding service gaps can assist all key stakeholders to have a consistent and coherent view of their service gap perceptions regarding ITSM processes that need improvement. The five service gaps regarding service quality perception proposed by Parasuraman, Zeithaml and Berry (1985) in their SERVQUAL model were analysed to determine service gap perception factors. Firstly the five service gap interfaces were analysed to determine service stakeholder involvement. Gaps 1 and 5 from the SERVQUAL model involved service customers and dealt with service expectation-perception gaps between customers and service providers. Similarly Gaps 2 and 3 involved internal service staff with deviations of the actual service delivery from service specifications. Likewise, Gap 4 dealt with communication issues between all service stakeholders during service delivery. Hence the five service gaps were grouped in three major areas based on service stakeholder interfaces: service expectation – perception gap; service specification – delivery gap; and service communication gap.

To address the three service gaps, three solutions were proposed that can be offered by IT services to address the service gaps simultaneously: value proposition; degree of confidence; and better communication. The three solutions were expanded to a total of nine specific service gap perception factors to focus on granular aspects in addressing the identified service gaps. Service value is defined by the utility and warranty of the service (TSO 2011). Therefore three service gap perception factors for value proposition included meeting expectations (warranty), budget effectiveness (utility) and important partner (utility and warranty). Likewise to define service gap factors for degree of confidence, interactions with three service stakeholder groups were determined: customer focus; staff morale; and service provider confidence. Finally better communication was defined by three service gap perception factors according to the key service communication avenues in an ITSM context: communication channels; business understanding; and process effectiveness.

According to the rationale for the survey design to understand service gap perception presented above, a service gap perception questionnaire was generated. The survey questions for each of the identified service gap perception factors are listed in Table 4.10. The survey questions were reviewed by P1. The questionnaire was then pilot tested with three IT service managers at USQ. A final question list was recompiled based on the feedback from the test. A typical 5-point Likert scale (5-Strongly Agree; 3-Neither Agree nor Disagree; 1-Strongly Disagree) was used to measure responses. This exercise was aimed to improve construct validity of the survey instrument.

Table 4.10 IT Service Gap Perception Survey Questions Based on SERVQUAL Model

Service gap	**ITSM solution to service gap**	**Service gap perception factor**	**IT service gap perception survey question**
Service Expectation-Perception Gap (Gap 1 & Gap 5)	Value proposition	Meeting Expectations	The IT service provider meets expectations regarding IT service delivery.
		Budget Effectiveness	The IT service provider spends its budget effectively.
		Important Partner	The IT service provider is a critical partner in helping to achieve business goals.
Service Specification-Delivery Gap (Gap 2 & Gap 3)	Degree of Confidence	Customer Focus	The IT service provider provides good customer service and addresses business requirements.
		Staff Morale	The IT service provider staff present themselves as happy and motivated.
		Service Provider Confidence	Business has a high degree of confidence in the IT service provider.
Service Communication Gap (Gap 4)	Better Communication	Communication Channels	There are adequate channels of communication between business and the IT service provider.
		Business Understanding	The IT service provider truly understands and assists business operations.
		Process Effectiveness	The IT service provider has implemented effective processes to support IT service delivery.

The results from the service gap perception survey provide an understanding of current service provision as perceived by key stakeholders and allow contrasts between different stakeholders' views to highlight service gaps between the provider (process managers and employees) and receiver of services (customers). Such triangulation facilitates validation of data through cross-checking thereby promoting reliability and validity (O'Donoghue & Punch 2003). The idea is to ensure there is sound communication across stakeholders about perceived service gaps before they categorise processes in terms of need for improvement. The results of the service gap perception survey are presented for discussion with all process stakeholders before they collectively make a group decision in consensus by categorising ITSM processes into five groups: Critical; Highly Important; Moderately Important; Marginally Important; or Not Important.

DSS implementation. The DSS sends a service gap perception questionnaire by email to all key process stakeholders and plots the survey results in a bar chart categorised by process stakeholder groups.

Using the results of the service gap perception survey, the DSS scores each ITSM process based on their relative importance: 4 – Critical; 3 – Highly Important; 2 – Moderately Important; 1 – Marginally Important; and 0 – Not Important. The maximum score that a process can achieve is 4 (4 - Critical) and the minimum score is zero (Not Important). This score, called "Service Gap Perception score", provides a metric of the importance of each ITSM process based on the service gap perceptions of stakeholders.

4.7.2.4 Produce a Process Selection Matrix

Method description. Based on the business driver score (*section 4.7.2.2*) and service gap perception score (*section 4.7.2.3*), ITSM processes are plotted to produce a process selection matrix. Figure 4.9 demonstrates the process selection matrix. This matrix represents the major outcome of the process selection method in the SMPA approach – hence proposed as a "nascent" design theory (Gregor & Hevner 2013).

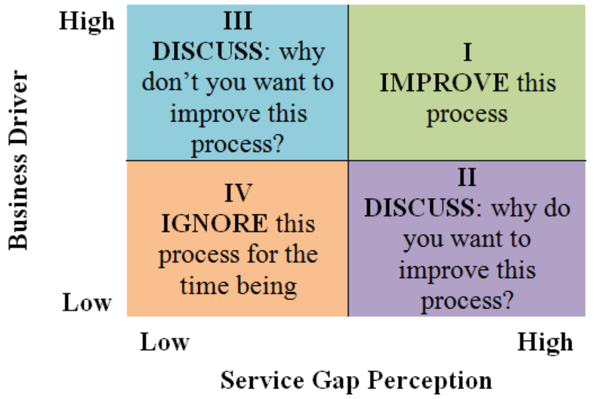

Figure 4.9 Process Selection Matrix

The process selection matrix can assist IT managers to select processes for improvement. A high score for both business driver and service gap perception means that the ITSM process lies in *quadrant I* – these processes must be seriously considered for improvement. These processes strongly support the business objectives of the organisation and are also perceived by key stakeholders as important processes to improve. The higher the position of the process at the upper right corner, the more critical is the process for improvement. Likewise, processes falling in *quadrant IV* can be ignored since they are not important to the business, and stakeholders are not interested. Since business priorities and improvement requirements may change frequently in a dynamic IT management environment, processes in *quadrant IV* may still need to be considered for improvement at a future date.

Processes falling in *quadrant II* and *III* should trigger discussions before a final decision is made on their selection for improvement. *Quadrant II* suggests that process stakeholders are keen to improve the process but these processes are not really important to the business at this stage. Further discussions about these processes should be made in regards to the rationale to choose them. If business value can be ascertained, these processes can be selected for improvement. Finally *quadrant III* suggests processes that have high business value but were not considered for improvement by stakeholders. Discussions about these processes may reveal, for example, that the process may have recently been through an improvement cycle or is being implemented at a satisfactory capability level hence does not require further improvement at that stage.

Overall the process selection matrix provides organisations with evidence-based decision-making support to select important ITSM processes to improve. Using this matrix, organisations can demonstrate that a rigorous method is applied for decision-making to select ITSM processes to assess and improve.

DSS implementation. The DSS computes the two score values for each ITSM process from step 2 and step 3 of the process selection method and plots the process selection matrix with all the processes. The DSS provides an interface to facilitate the business driver ranking exercise, service gap perception surveys, process rankings and presentation of the process selection matrix to assist service managers in decision-making.

4.7.3 Process Role Allocation

Method description. In this step, information about the assessment participants and their process roles for relevant processes are captured. Three process roles associated with any ITSM process: process performer (PP); process manager (PM); and external process stakeholder (EPS) were suggested by Barafort et al. (2009) and used in this step. Key information recorded in this step is captured using an assessment participant sheet. This sheet stores information about assessment participants including their name, work email address, relevant ITSM processes and the process role for each of the processes. A template of the survey participant information sheet is provided in **Appendix D.2** (p. 249).

DSS implementation. The information about the process stakeholders and their roles in each process is input to the DSS. **Appendix E.2** (p. 254) presents a screenshot of the DSS where details of a process stakeholder participating in the survey are captured.

After recording the survey participants, the facilitator console of the DSS constitutes a drag-and-drop interface to allocate survey participants to one of the process roles for every process as illustrated in **Appendix E.3** (p. 255). This also means that in the background, the DSS allocates relevant surveys to each survey participant based on their process roles in each process. A single survey participant can assume multiple roles in different processes but each participant is always exclusively allocated to one role for each process. The DSS applied this logic in process role allocation to the assessment questions.

4.8 Phase 2. Survey

***Method description*.** While existing ITSM process assessments rely on process-specific indicators that demonstrate objective evidence of process capability, the SMPA approach facilitates a top-down approach where each ITSM process is defined with a goal and then assessment is guided by explicit questions and metrics that are set to goal attainment. The structure of the survey questionnaire is guided by the GQM approach (Basili, Caldiera & Rombach 1994). Following the GQM approach, assessment goals are specified for every process attribute of each process followed by relevant survey questions based on the standard PAM. Goal template defined by Basili, Caldiera and Rombach (1994) has been applied in the SMPA approach while assessing the process attributes of each process.

The structure of a goal statement template with an example of the Problem Management process being assessed for PA2.1 is listed in Table 4.11.

Table 4.11 A Sample Goal Statement Template Used in the Assessment Survey

Criterion	**Value**	**Example**
Analyse *(the object of assessment)*	PROCESS	Problem Management process
For the purpose of *(improving the object)*	ASSESSMENT GOAL	Continual service improvement
With respect to *(the quality focus of the object that the measurement focuses on)*	PROCESS ATTRIBUTE	PA2.1 Performance Management (managing process performance)
From the viewpoint of *(the people who measure the object)*	PROCESS ROLE	PP, PM or EPS
In the context of *(the environment in which the measurement takes place)*	ASSESSMENT PROJECT	Research project to trial the SMPA approach

The application of an objective GQM approach in the SMPA approach was driven by the design principle of facilitating assessment workflow to address the task challenge of the *lack of transparency*, as discussed previously in the fit profile. In a formal ISO/IEC 15504 assessment, the base and generic practices from the PRM and PAM are used as indicators to enable a formal evaluation of the process capabilities. In the context of this research, the emphasis is to provide information that can drive improvement of ITSM processes. These indicators are translated into a set of assessment questions for the survey.

Existing ITSM process assessment methods have assessment indicators that are not designed to obtain information directly from process stakeholders for automated data collection. Instead all assessment indicators are designed for assessors to use during assessment interviews. In this research however, assessment questionnaires are developed for completion by process stakeholders directly. The questionnaires map each of the standard assessment indicators from the PAM in ISO/IEC 15504-8. The questions are then allocated to the three process roles (PP, PM or EPS) according to the relevance of each question to each process role. Finally, the survey questions were reviewed following the iterative design process as the artefact component went through three checks: industry relevance check; standards alignment check; and academic rigour check, as illustrated in Figure 4.2.

To check for errors, the questionnaire designed for the SMPA approach was pre-tested by three process managers at USQ’s IT department. The structure and format of the process assessment questions for the four ITSM processes were discussed with the three process managers. Process managers were requested to provide feedback on their understanding, clarity and relevance of the questions to the processes. No reference about the use of the international standard guidelines was provided so that the process managers had the freedom to make any comments on the questions.

During the pre-test, the three process managers were requested to fill in a sample questionnaire; to comment on the grammar, readability and length; and to provide a general response. Eighteen responses were received from the three process managers. Several typographical and grammatical errors were identified and amended by this researcher without recourse to the team. Several constructive comments on the wording and the format of the questions were received via face-to-face discussions and in email. Changes were applied to the questions accordingly in order to enhance readability of the questions. This is an example of a formative *ex-ante* evaluation process followed during the design of the survey questionnaire before sending the questions out to the case study participants. The testing allowed for an improvement on the sequencing of questions and provided an estimate of the length of time needed to complete the survey. The layout of the questionnaire was improved to include a brief message about the project upfront and use of the goal statements to break assessment questions into logical groups.

The logic applied to transform the standard indicators to questions is discussed next. The base practices provided by ISO/IEC 20000-4 (process dimension) and the generic practices provided by ISO/IEC 15504-8 (capability dimension) were used to develop the questionnaire for each process. All the standard indicators, i.e. base practices for each process and the generic practices, were reviewed. Assessment questions for the survey were generated by analysing all standard indicators to construct singular, fine-grained and close-ended assessment questions. The questions were then reviewed following the iterative design process to ensure industry relevance, standards alignment and academic rigour during their transformation.

A total of 46 questions specific to the four processes at capability level 1 (PA1.1) and 127 general questions for all processes at capability levels greater than 1 (PA2.1 to PA5.2) were generated. A total of 63 standard indicators (base practices for four ITSM processes and all generic practices) were transformed into a set of 173 assessment questions. The reason for a larger number of assessment questions is they were granular to the level of each criterion specified in a standard indicator. Several indicators had two or more criteria often specified in multiple sentences examining specific aspects of the indicator. In such cases multiple questions were generated from a single standard indicator.

An example to illustrate how an assessment question was generated from a standard assessment indicator is discussed next. For the Problem Management process, one of the indicators of the process is “problems are resolved and closed” (ISO/IEC 2012b, clause 5.13). In order to address this indicator, the base practice was prescribed as “RES.3.3 Resolve and close problems” which says that the problems should be resolved and closed once resolved. The standard also says that the “problem disposition record” is the input and output for this indicator. After analysing all these requirements from the standard, two questions that align with the standard were developed for the assessment:

(a) Do you know if problems are effectively resolved? *NOTE: problems are effectively resolved when a workaround (or even better a permanent solution) has been found.*
(b) Do you know if resolved problems are successfully closed? *NOTE: problems are successfully closed when they are effectively resolved and a known error record is generated.*

After a final set of assessment questions were confirmed, the rationale used to allocate process roles to each assessment question was developed. The rationale for process role allocation depends on the scope of the question. Using a Delphi method in three rounds (Linstone & Turoff 1975), the allocation of process roles – PP, PM and EPS – in terms of their relevance to each question was decided. Five of the research members participated in the Delphi method (P1-P3, A1 and this researcher). The Delphi method was suitable for this activity since it provides a structure to enable a group of experts to deal with a complex problem using an effective process (Dalkey & Helmer 1963). A protocol was agreed upon and followed by the research team to guide process role allocation to each assessment question as described in Table 4.12.

Table 4.12 Protocol for Process Role Allocation to Assessment Question

Process Attribute	**Role**	**Rationale**
PA1.1	Primary role: **PP** Second opinion: **PM** and/or **EPS**	PA1.1 deals with process performance; hence allocate questions to PP as the primary role. If the question also deals with process management AND interfaces (inputs/ outputs), allocate the question to both PM and EPS. If the question also deals with process management OR interfaces (inputs/ outputs), allocate the question to PM or EPS accordingly.
PA2.1 to PA4.2	Primary role: **PM** Second opinion: **PP** and/or **EPS**	PA2.1 to PA4.2 deal with process management, process standardisation and process control, hence allocate questions to PM as the primary role. If the question also deals with performing process activities AND interfaces (inputs/ outputs), allocate the question to both PP and EPS. If the question also deals with performing process activities OR interfaces (inputs/ outputs), allocate the question to PP or EPS accordingly.
PA5.1 to PA5.2	Primary role: **PM** Second opinion: **None** or **PP** or **EPS**	PA5.1 and PA5.2 deal with process innovation and optimisation, hence allocate questions to PM as the primary role. In some cases questions at this level almost exclusively belong to the role of PM, hence no second opinion is sought. In some cases, if the question also deals with performing process activities OR interfaces (inputs/ outputs), allocate the question to PP or EPS accordingly.

Following the protocol described in Table 4.12, a primary role was determined based on the process attribute to which each question belongs. Then a second opinion was sought from another relevant process role for the question. In some cases all three process roles were allocated to a question if the question typically relates to all three process role activities: process performance; process management; and process interfaces. However in PA5.1 and PA5.2 a second opinion is not sought for some questions that exclusively relate to process management.

The survey questionnaire along with the process role allocation was evaluated for its relevance, validity and practicality following the iterative design process. P1 reviewed the questions with P2 and P3 and provided his input to make the questions relevant to industry with examples and practical cases where possible. After a new version of questionnaire was produced (v2.0), it was then reviewed by S1 in terms of the alignment of the questions with the standard indicators. Valuable input was received from S1 in terms of specific feedback and several general suggestions which were subsequently incorporated in the questions where applicable. One of the significant changes suggested by S1 was to change the prefix of each assessment question from "Do you think…" to "Do you know…" since he suggested that the assessment questions should seek direct information rather than an opinion about the process activities: "*in combination with a lack of knowledge of the interest group, 'Do you think…' questions can encourage those without direct involvement in the process to provide more positive responses.*" The questions were also reviewed with A1-A3 for clarity and relevance of the questions to the process. Pre-testing of the survey questionnaire from different perspectives helps to establish the reliability and validity of the questionnaire (Creswell 2009). Hence expert help was recruited and four iterations of "develop-evaluate" cycles (Hevner 2007) were executed to produce the final set of questions and the process role allocation to each question.

The structure of the online survey was established with three major components. The first was using a goal statement template to state the objectives that drive a set of assessment questions. Nine process attributes in the standard PAM for every process provide different aspects of each process being assessed. Therefore nine goal statements were developed and used based on process attributes for each process. Likewise, the second component is a set of close-ended assessment questions that were transformed from the standard indicators for relevant process stakeholders to answer. Finally, the third component is called the metric component that provide consistent answer options for every question, enabling a structured method in assessment data collection and analysis. This structure is driven by the GQM principle. Alignment of the online survey with the GQM approach meant that the questionnaire met data gathering and quality requirements.

DSS implementation. The final questions and process role allocation to the questions were provided to the research partner AP for implementation in the DSS platform. Once the questions were implemented, the DSS was thoroughly tested by engaging in a number of trial online surveys. The online survey was also pilot tested with three process managers at USQ's IT department to obtain feedback on the survey interface.

The DSS is designed to collect quality data for measurement. Using the DSS, the responsibility to provide information about process capability is transferred to the process stakeholders. This shift from the current practice where assessors are responsible to collect assessment data means that with the SMPA approach, the assessors do not need to conduct interviews and make subjective judgments on process capability. For example, an assessor's open-ended question for the problem management process based on the base practice "RES.3.1 Identify problems" could be "Can you tell me about recording of the problems?" By comparison, the assessment question in the survey is formed as "Do you know if identified problems are properly recorded?" in a close-ended format, so that the assessment facilitator can analyse survey responses objectively based on a concrete set of answer options.

The survey used a cross-sectional, self-administered web-based questionnaire, offered online. The procedure and design of the survey was chosen to be online as it is low cost, easily accessible, provides a fast response, and data collected would be available in electronic format (Sheehan 2001). In order to cover all the assessment indicators from the standard PAM, no branching logic was applied in the questionnaire design. The survey questionnaire had different questions for all processes in PA1.1 (CL1) since this level relates to specific base practices for each process. The number of questions is listed in Table 4.13.

Table 4.13 Survey Questions for Base Practices for Each Process

Process	**No. of base practices**	**No. of questions in PA1.1**
Problem Management (PrM)	6	11
Change Management (ChM)	7	14
Service Level Management (SlM)	5	9
Configuration Management (CoM)	5	12
TOTAL	**23**	**46**

The survey questionnaire had common questions for all the processes from process attributes PA2.1 (CL2) to PA5.2 (CL5) since these process attributes relate to generic practices for all processes. The only word that was replaced in the survey question for each process was the specific name of the process being assessed. The number of questions is listed in Table 4.14.

Table 4.14 Survey Questions for Generic Practices for All Processes

Process Attribute	**No. of generic practices**	**No. of questions**
PA2.1 Performance Management	6	24
PA2.2 Work Product Management	4	14
PA3.1 Process Definition	5	14
PA3.2 Process Deployment	6	13
PA4.1 Process Measurement	6	18
PA4.2 Process Control	5	13
PA5.1 Process Innovation	5	19
PA5.2 Process Optimisation	3	12
TOTAL	**40**	**127**

Finally the number of allocations of process roles to assessment questions is provided in Table 4.15.

Table 4.15 Final Number of Allocation of Process Roles to Assessment Questions

Process Attribute	**PP**	**PM**	**EPS**	**Note**
PA1.1 (PrM)	11	3	9	1 question to all 3 roles
PA1.1 (ChM)	14	3	12	1 question to all 3 roles
PA1.1 (CoM)	12	4	10	2 questions to all 3 roles
PA1.1 (SlM)	9	2	7	2 questions to all 3 roles
PA2.1 Performance Management	23	24	6	5 questions to all 3 roles
PA2.2 Work Product Management	7	14	7	N/A
PA3.1 Process Definition	12	14	2	N/A
PA3.2 Process Deployment	13	13	2	2 questions to all 3 roles
PA4.1 Process Measurement	11	18	7	N/A
PA4.2 Process Control	12	13	1	N/A
PA5.1 Process Innovation	11	19	3	5 questions exclusive to PM
PA5.2 Process Optimisation	5	12	4	3 questions exclusive to PM

All responses contribute equal weight to the question. However the allocation of the three process roles to the survey questions causes different number of questions for each respondent according to their process roles, as listed in Table 4.15. At CL1, the process performer (PP) is the primary role and all questions belonging to PA1.1 are allocated to the PP role. At higher capability levels, the primary role for all questions is the process manager (PM) role. The protocol for process role allocation to assessment questions was provided in Table 4.12. In this way all responses are implicitly weighted according to how the process roles are allocated to the assessment questions.

Two artefact components, the survey questionnaire and the process role allocation to the assessment questions, were provided to the industry partner AP to implement the DSS. These components were integrated in the existing DSS platform in May 2013 to enable DSS functionality to administer the survey.

The DSS sends an email with a direct link to the assessment survey website that then gathers responses to each question. **Appendix E.4** (p. 256) illustrates the DSS feature of sending emails to survey participants. The user interface design for the survey is discussed next.

4.8.1 Survey User Interface in the DSS

Guenther (2004) stated that having a clear set of interface design objectives for the users of a website helps to make the online environment highly valuable. This research had two sets of distinct users: assessment facilitators and process stakeholders. Consequently, the DSS had to meet two different sets of design objectives and expectations. Regarding the survey developed with an online web interface, Calongne (2001) argued what the user wants to achieve from a website must be considered. Therefore, an uncluttered web page without too many elements claiming attention helps the survey respondent make sense of the page and focus on the central element, i.e. the question in this case. Also, graphics should be used only when necessary to illustrate or add to the survey function (Yen, Hu & Wang 2007). In the online survey, the questions were of a large font size and the maximum contrast of black sans-serif text (Arial font) was used on a plain white background using a light blue colour for highlighting.

A survey respondent tries to make logical sense of a survey page at first glance, so the design of the page must make logical sense; for instance, questions should be in a large font and clear options to move forward and backward must be provided. Design elements that are related need to be gathered together graphically, for example each question was contained within a frame. The graphical placement of these elements was consistent and predictable throughout the survey interface to aid usability (Williams 2000). A linear website plan, where the user moves through the online survey with each question page by page, helps to orientate the user so that they are aware of the progress they are making during the survey (Guenther 2004; Yen, Hu & Wang 2007). These requirements were met in the online survey with the provision of logical grouping of questions based on the process attribute levels alongside the estimated time to complete and percent completion demonstrating survey progress. **Appendix E.5** (p. 257) illustrates the first page of the online survey interface to login with the email address of the assessment participant.

The heuristic evaluation rules for online web pages detailed by Rogers, Sharp and Preece (2011) were employed. The online survey had internal consistency, with words carrying a standard meaning throughout the survey pages using a consistent language. To aid internal consistency, formatting of pages, fonts, font sizes and font colours were made consistent for all pages of survey questions. Shortcuts were not used since the online survey interface had a simple linear format which must be followed sequentially to provide responses. The respondent’s memory load was minimised with no information being required to be remembered from one question to another in different web pages. Entries into the database from the online survey were automatically validated; for example the only way to progress forward in assessment questions is to answer the existing question and this was instantly stored in the DSS before moving to a new question.

In line with the ethics application, the first time a survey respondent logs into the survey interface, they are asked if they give their consent to their input being used in this research. This was detailed in the email sent with the survey link and re-iterated on the first page after login. The welcome page after login is shown in **Appendix E.6** (p. 258).

Before a set of questions belonging to one process attribute was introduced, a goal statement was displayed in the survey screen to remind the survey respondent about the process being assessed and the purpose, role, capability level, process attribute and the context of the upcoming assessment questions in the survey. **Appendix E.7** (p. 259) shows a screenshot of the online survey that displays a goal statement.

All questions were progressed through the online survey interface with a consistent set of answer options for every question. The questions highlighted the process being assessed and there were examples belonging to the relevant ITSM processes where applicable. **Appendix E.8** (p. 260) illustrates an assessment question displayed in the online survey interface.

After the completion of each section, a message was displayed to the survey respondent that a group of questions relating to a particular process attribute has been completed. Since a survey participant may go through a considerable number of questions in one survey, one question at a time, this step provided the participant a useful point to pause their assessments before they start the next set of questions for the new process attribute with a new mindset at a different time. **Appendix E.9** (p. 261) displays the online survey screenshot that concludes one of the sections before the goal statement of another set of questions is displayed.

Using the facilitator console of the DSS, the assessment facilitator is able to track progress made in each survey by each participant. This functionality enables the assessment facilitator to ensure that assessment data collection is completed on time. **Appendix E.10** (p. 262) provides a screenshot of the survey tracking interface in the facilitator console of the DSS.

4.9 Phase 3. Measurement

Method description. The assessment questions were grouped to determine process capability levels 1-5 and every question was designed to have consistent answer options using the rating scale: Not (N), Partially (P), Largely (L) and Fully (F) – also referred as the NPLF scale – as defined in the measurement framework of the ISO/IEC 15504 standard. This rating is a knowledge metric to capture what ITSM process stakeholders know about the process. Rather than the assessment team making a subjective choice of the indicator rating, the SMPA approach uses the metric to collect and objectively measure feedback from the process stakeholders directly. This dimension of measurement constitutes the “metric” component of the GQM approach which is applied in this research.

Besides the four-point NPLF rating scale, every question also has a “Don’t Know” (DnK) option and a “Don’t understand the question” (DnQ) option. The DnK option suggests that the survey participant understood the question but there is a lack of communication and understanding in regard to the aspect of the process being questioned. Therefore even though the DnK option was not used in the process capability calculation, it provides a metric that suggests risks in terms of communication issues or process shortcomings. The DnQ option is a metric to prompt the assessment facilitator to have a discussion with the relevant survey participants about the question for clarity of the concepts, particularly if there are many DnQ responses for a particular question. The DnQ option is also a useful metric for research purposes to carefully review the question's wording and process role allocation to improve the relevance and clarity of the question. Every question also features a comment text box to capture qualitative contextual data. Such textual information can be analysed by an assessor to validate responses and provide specific recommendations in the assessment report.

The ISO/IEC 15504-2 requirements are used for the calibration of process attribute ratings. According to the measurement framework in the standard, a particular capability level can be achieved if a process meets two conditions: (a) the target level is fully or largely achieved, i.e. the rating of "Fully" or "Largely" for the process attributes at that level; and (b) the lower levels are fully achieved, i.e. the rating of "Fully" for all lower level process attributes. For example, a process can only achieve CL3 if it obtains a "Fully" or "Largely" score in PA3.1 and PA3.2 and all process attributes below CL3 (i.e. PA1.1, PA2.1 and PA2.2) have a "Fully" score. Since the objective of this research is to provide a transparent method to conduct process assessments, the final score of each process attribute is determined by calculating the arithmetic mean value of all the responses using the scale percentage based on the ISO/IEC 15504 standard measurement framework.

Table 4.16 provides the rating scale defined in the ISO/IEC 15504 standard along with the mean value of the scale percentage that is used for score calculation. For example when an answer option is "Yes, most of the time", it corresponds to the "Largely" rating scale where the scale percentage is between 50 - 85%. Therefore, the score for that response is the average of 50 and 85 which is 67.5.

Table 4.16: NPLF Rating Scale Based on the ISO/IEC 15504 Standard

Answer option	**Rating score**	**Scale %**	**Mean value of a response (*x*)**
No, never	N	0 - 15	7.5
Yes but only sometimes	P	>15 - 50	32.5
Yes, most of the time	L	>50 - 85	67.5
Yes, always	F	>85 - 100	92.5

The coefficient of variation (*CoV*) is also computed to analyse trustworthiness of the process attribute score based on data dispersion. A lower *CoV* suggests low variability in the responses which boosts the degree of confidence of the score and vice versa. The *CoV* measure therefore checks the spread of the responses to determine a corresponding reliability score for the process attribute score.

The algorithm used to measure process capability in order to develop an assessment profile for a process is illustrated in Figure 4.10.

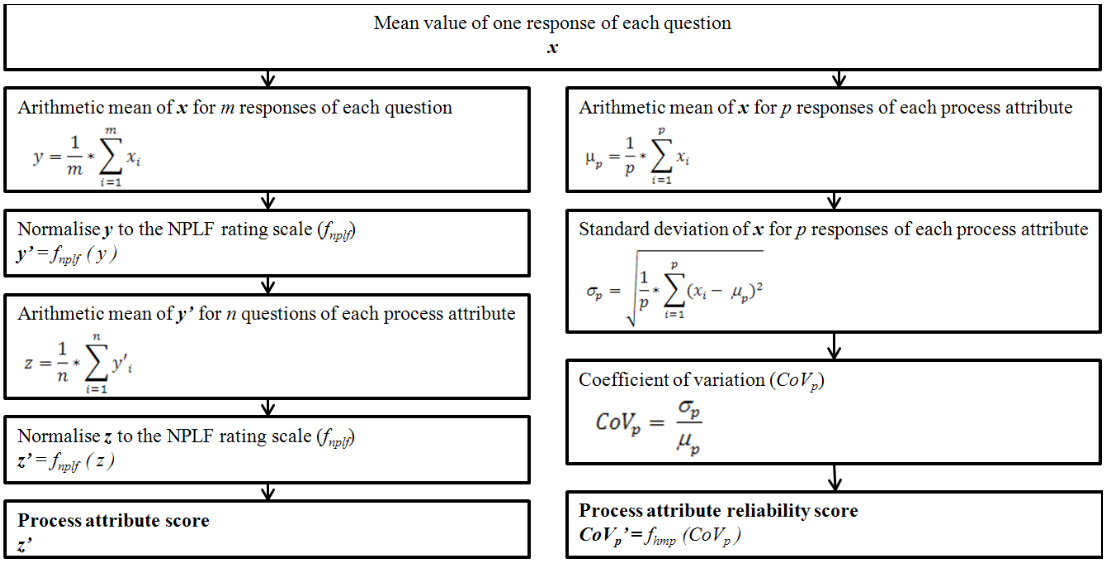

Figure 4.10 Algorithm for Calculation of Process Attribute Score and Reliability Score

The process attribute scores are calculated from the following steps:

1. Since each of the four valid answer responses for a question (NPLF) are mapped to the rating scale, the mean value of a response (x) is determined based on Table 4.16. DnK and DnQ responses are ignored.
2. For all m responses belonging to one question, the arithmetic mean of x is calculated (y). The reliability of the process attribute score increases when there is a larger value of m due to higher number of responses for a process. However m depends on the size of the organisational unit being assessed.
3. y is normalised to the NPLF rating scale (f_{nplf}) defined in Table 4.16 (y').
4. For all n questions belonging to one process attribute, the arithmetic mean of y' is calculated (z). All questions contribute equal weight to the process attribute as they relate to assessment indicators defined by the ISO/IEC 15504 standard.
5. z is normalised to the NPLF rating scale (f_{nplf}) as defined in Table 4.16 (z'). z' is the process attribute score for the process.

The calculation of process attribute reliability score is discussed next.

1. Since each of the four valid responses for a question (NPLF) are mapped to the rating scale, the mean value of a response (x) is determined based on Table 4.16. DnK and DnQ responses are ignored.
2. For all p responses belonging to all questions of a process attribute, the arithmetic mean of x is calculated (μ_p). The reliability of the process attribute score increases when there is a larger value of p due to higher number of responses for a process. However p depends on the size of the organisational unit being assessed.
3. For all p responses belonging to all questions of a process attribute, the standard deviation of x is calculated (σ_p). The standard deviation σ_p shows how much dispersion from the arithmetic mean μ_p exists. A low σ_p indicates that all responses are close to μ_p. A high σ_p suggests that the responses are spread over a large range of answer options.

4. Coefficient of variation (CoV_p) is calculated from the σ_p and μ_p as illustrated in Figure 4.10. CoV_p is expressed as an absolute value percentage (relative standard deviation) that can be used to check the spread of the responses to determine reliability of the final process attribute score.
5. The reliability score (CoV_p') is determined based on the percent value of CoV_p and the range of acceptable variation of responses as defined by a function (f_{hmp}). The logic of the function f_{hmp} groups the CoV_p value into one of three categories based on a scale of dispersion of responses. The research team confirmed the logic to cluster CoV_p value of less than 30% as a "high" reliability score, CoV_p value of over 50% as a "poor" reliability score and anything in between as a "moderate" reliability score. The decision rule of the function f_{hmp} is provided next.
   a. If CoV_p < 30%, CoV_p' = "HIGH"
   b. If CoV_p between 30% and 50%, CoV_p' = "MODERATE"
   c. If CoV_p > 50%, CoV_p' = "POOR"

The use of arithmetic mean and coefficient of variation are a simple yet effective statistical measure to understand what the critical mass of the assessment respondents think about the processes. The final outcome is the development of an assessment profile that includes all the process attributes scores and their reliability scores along with the rationale for the ratings (ISO/IEC 2011c).

The need to provide an explanation of the logic of process capability measurement is paramount in this research, as one of the critical factors for assessors and process managers is transparency about how the process capability scores are derived. The lack of transparency can be a barrier to adoption in the process assessment discipline since assessors and process managers must be able to justify the assessment and process improvement efforts. An explanation of a sound logic of process measurement is expected to lead to increased satisfaction and trust in the SMPA approach by process managers. The provision of reliability score based on a statistical measure of coefficient of variation (*CoV*) and the inclusion of number of responses in the process profiles provide confidence to accept the assessment results. Therefore, simple rule-based logic is applied in this research since each decision point was simplified to a Not-Partially-Largely-Fully (NPLF) response for the process activities. The transparency and simplicity of the process measurement ensure that the SMPA approach is flexible and easy to change in the event of alterations in the questions, standard measurement framework and/or calculation logic.

As part of the iterative design process, the logic for process capability calibration was checked by all members of the research team. S1 stated that this logic cannot be fully compliant with the requirement for ISO/IEC 15504 Part 2 as a stand-alone determinant of process capability. However he supported the measurement logic of process capability saying, "*…it will be interesting what evaluation results demonstrate because the logic seems rational. I cannot see why this cannot be used as one of the measures to determine standards-compliant process assessment results … At least this gives an indication of what is needed to improve the process*". With a notion that the logic is looking for an indicative score for improvement rather than a precise metric, the process measurement functionality produces an assessment profile that is included in the assessment report.

A formal assessment is conducted by taking multiple factors into consideration: manifold objective evidence; observations; document reviews; and expert judgment. The use of the mean value and the coefficient of variation are nonetheless proposed as important indicators for an assessor to conduct objective process assessments. Moreover automating process attribute rating with a logical approach can drive self-assessments by ITSM organisations and assist internal staff to conduct informal self-assessments in order to understand the current level of process capability. Automation in process capability measurement is a major driver to develop the SMPA approach in support of transparency and efficiency. The focus of measurement is not on precision, but for indication of process improvement due to repeated use of the SMPA approach in order to facilitate CSI.

DSS implementation. The online survey questions are answered by clicking on a graphical Likert-like response scale that are consistent across all questions. At each decision point for every question there are six distinct response options available: NPLF; DnK; and DnQ. Minimal typing is required during completion of the survey questions unless process stakeholders provide additional optional information in a comments box for each question. The six answer options align with the ISO/IEC 15504 rating scale and are implemented in the DSS as listed in Table 4.17.

Table 4.17 Survey Answer Options Aligned with the ISO/IEC 15504 Rating Scale

Answer option in the survey	**ISO/IEC 15504 rating scale**	**Mean value of a response (*x*)**
Yes, always	Fully (F)	92.5
Yes, most of the time	Largely (L)	67.5
Yes but only sometimes	Partially (P)	32.5
No, never	Not (N)	7.5
Do not know or unable to comment	DnK (N/A)	N/A
I do not understand the question	DnQ (N/A)	N/A

The algorithm of the calculation of process attribute score and reliability score presented in Figure 4.10 was implemented as a structured query language (SQL) stored procedure in a Microsoft SQL database server by a database programming team working for the research partner AP. The assessment profile generated based on the measurement algorithm was re-validated for consistency and accuracy. A template of the assessment profile for a process is provided in Table 4.18.

Table 4.18 Template of Assessment Profile for a Process

	Level 1	**Level 2**		**Level 3**		**Level 4**		**Level 5**	
Profile	PA1.1	PA2.1	PA2.2	PA3.1	PA3.2	PA4.1	PA4.2	PA5.1	PA5.2
Process attribute score	***Z’***	***Z’***	***Z’***	***Z’***	***Z’***	***Z’***	***Z’***	***Z’***	***Z’***
Reliability score	CoV_p'	CoV_p'	CoV_p'	CoV_p'	CoV_p'	CoV_p'	CoV_p'	CoV_p'	CoV_p'
Number of responses	***p***	***p***	***p***	***p***	***p***	***p***	***p***	***p***	***p***

From the total number of responses (p), it could be determined if the average score for a particular process activity has risks, i.e. a process attribute score (z') being a “Not”

(N) or “Partially” (P); and a reliability score (*CoV_P’)* being “Poor” that suggests a dispersion of responses. Moreover the number of respondents provides an indication of the representativeness of the assessment profile. If a particular process has three stakeholders and all provided responses in the assessments, it is a 100% representative sample. However, in the case that there are three respondents for a process that has fifteen stakeholders, the entire assessment profile may not be representative of the actual process capability regardless of high scores in the process attribute score or reliability score.

The DSS also generates a pie chart showing a breakdown of survey responses for each process with the percentage of valid answers considered for process measurement i.e. NPLF and the proportions of DnK and DnQ responses that were ignored in the calculations. The DSS implemented the process measurement logic behind the scenes; however the rationale and process of calculation of the process attribute score and reliability score was presented in the assessment report generated by the DSS.

4.10 Phase 4. Improvement

Method description. After each process questionnaire was formulated, knowledge items were generated for all questions based on the best practice guidelines of the ITIL framework. A knowledge item for each question is extracted from the knowledge base and compiled in the assessment report when the normalised mean of all responses to the question – referred to as the knowledge item score for the question – demonstrates risks (i.e. a knowledge item score of Not or Partially). The calculation of process attribute score and reliability score as described in Figure 4.10 are applied for the calculation of knowledge item score and knowledge item reliability score as well – the only difference being that in this case the calculations are undertaken to the question level.

The algorithm used to determine the knowledge item score and knowledge item reliability score is illustrated in Figure 4.11 and the discussion of the steps follow.

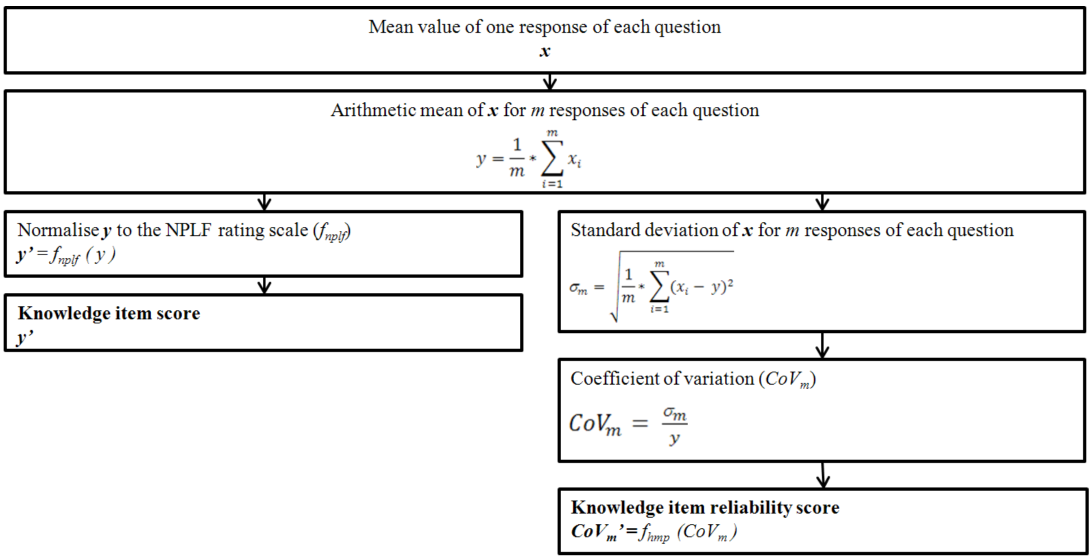

Figure 4.11 Algorithm for Calculation of Knowledge Item Score and Reliability Score

The knowledge item score is calculated based on these steps:

1. The mean value of a response (*x*) is determined based on Table 4.16. DnK and DnQ responses are ignored.
2. For all *m* responses belonging to one question, the arithmetic mean of *x* is calculated (*y*).
3. *y* is normalised to the NPLF rating scale (f_{nplf}) defined in Table 4.16 (*y'*). *y'* is the knowledge item score for the knowledge item associated with the question.

Likewise, the calculation of knowledge item reliability score is performed:

1. The mean value of a response (*x*) is determined based on Table 4.16. DnK and DnQ responses are ignored.
2. For all *m* responses belonging to one question, the arithmetic mean of *x* is calculated (*y*).
3. For all *m* responses belonging to one question, the standard deviation of *x* is calculated (σ_m).
4. Coefficient of variation (CoV_m) is calculated from the σ_m and *y* as illustrated in Figure 4.11. CoV_m is expressed as an absolute value percentage (relative standard deviation) that can be used to check the data dispersion of the responses to the question associated with the knowledge item.
5. The reliability score (CoV_m') is determined based on the percent value of CoV_m and the range of acceptable variation of responses as defined by a function (f_{hmp}) in Figure 4.11. The logic of the function f_{hmp} groups the CoV_m value into one of three categories based on a scale of dispersion of responses. The research team confirmed the logic to cluster CoV_m value of less than 30% as a "high" reliability score, CoV_p value of over 50% as a "poor" reliability score and anything in between as a "moderate" reliability score. The decision rule of the function f_{hmp} is provided next.
   a. If CoV_m < 30%, CoV_m' = "HIGH"
   b. If CoV_m between 30% and 50%, CoV_m' = "MODERATE"
   c. If CoV_m > 50%, CoV_m' = "POOR"

A knowledge item score of Not (N) with a reliability score of "High" suggest that the corresponding knowledge item for the question should be highly considered for process improvement. This is because this knowledge item is derived from a high risk process area where the corresponding question related to the process has a score of "Not" (N). Likewise if a knowledge item score is "Fully" (F), it demonstrates process areas of strength and therefore such knowledge items are not represented as recommendations for that assessment. Since every question has an associated knowledge item, a fine-grained analysis to generate process improvement recommendations as described here is possible.

For every assessment question, two components – observation and recommendation – are combined to generate a process improvement knowledge item. The observation component of a knowledge item lists the current state of the process capability. For instance, if a process is at CL2, observations provide an account of the current state of what is being done to ensure this capability level is maintained. This information is transformed from the relevant question itself. Likewise the recommendation component of a knowledge item for the process is based on the best practice guidelines from the ITIL framework to achieve higher capability levels. To illustrate the generation of a knowledge item, a scenario can be considered. If a question asked “Do you know if X is performed?” and the average response value i.e. the knowledge item score is “No”, the associated knowledge item may consist of two components as listed below:

(a) Observation: “X is not performed well”; and
(b) Recommendation: “According to ITIL, Y can be considered to perform X well”.

For all 173 assessment questions generated in this research, 151 corresponding knowledge items were developed to address risks associated with the process in question. At PA1.1 every question had a corresponding one-to-one knowledge item. However at higher process attributes the same knowledge item was used for multiple questions in a number of instances since some of the questions were closely related and could be addressed by a single knowledge item. At PA1.1 the recommendations are specific to the process in question. From PA2.1 onwards, the recommendations are developed as general guidelines that may apply to any process. Specific examples are provided to clarify recommendations where applicable. The total number of questions and associated knowledge items for each process attribute is specified in Table 4.19.

Table 4.19 Assessment Questions and Knowledge Items

Process attribute	**No. of questions**	**No. of knowledge items**
PA1.1 (PrM)	11	11
PA1.1 (ChM)	14	14
PA1.1 (CoM)	12	12
PA1.1 (SlM)	9	9
PA2.1 Performance Management	24	21
PA2.2 Work Product Management	14	13
PA3.1 Process Definition	14	11
PA3.2 Process Deployment	13	9
PA4.1 Process Measurement	18	13
PA4.2 Process Control	13	11
PA5.1 Process Innovation	19	16
PA5.2 Process Optimisation	12	11
TOTAL	**173**	**151**

Not all knowledge items had both observation and recommendation components. Particularly for higher levels of process capability, the knowledge item only consists of an observation since it was too broad and abstract to provide a specific recommendation. The knowledge items are associated with each question for every process and are aligned with ITIL best practices for specific processes wherever applicable. This exercise ensures that the assessment report is relevant, accurate and granular within the defined capability levels for every process.

Table 4.20 demonstrates the transformation of a standard process indicator into an associated question and a knowledge item.

Table 4.20 Representation of a Process Indicator as an Assessment Question and Knowledge Item

Instrument	**Component**	**Description**
ISO/IEC 15504 PAM	Process Attribute	PA2.1: Performance Management
	Generic Practice	GP 2.1.5: Identify and make available resources to perform the process according to plan.
	Process Indicator	The human and infrastructure resources necessary for performing the process are identified, made available, allocated and used.
SMPA Approach	Assessment question	Do you know if sufficient human and infrastructure resources are available to perform <PROCESS> activities? *NOTE: consider people, partner, process and technology as resources.*
	Knowledge item	**Observation**: Sufficient human and infrastructure resources are not available to perform <PROCESS> activities. **Recommendation**: Proper human and infrastructure resources include competent people, reliable partners (vendors and suppliers), well-performed processes (based on ITIL guidelines) and relevant technologies (e.g. ITSM tools). These resources should be sufficient enough to perform <PROCESS> activities effectively. It is especially important to be prepared to make appropriate changes to the resources as the process is changed for improvements.

DSS implementation. After the final knowledge items were developed, a knowledge base in the DSS stored the knowledge items. Using the knowledge base, the DSS can perform gap analysis based on the process attribute scores and produce a report with specific improvement recommendations for a process. The knowledge base is developed with process improvement recommendation items at the question level for the four selected processes in this research. When the average response for each question, i.e. the knowledge item score, is either "partially" (P) or "not" (N), the corresponding knowledge item associated with the question is extracted from the knowledge base. Finally, relevant knowledge items are compiled to develop the assessment report. All of the processing occurs behind the scenes and the assessment facilitator is only required to click a button to generate the report once the assessment data collection is completed. Figure 4.12 presents a DSS screenshot that shows the interface of the facilitator console used to generate the assessment report.

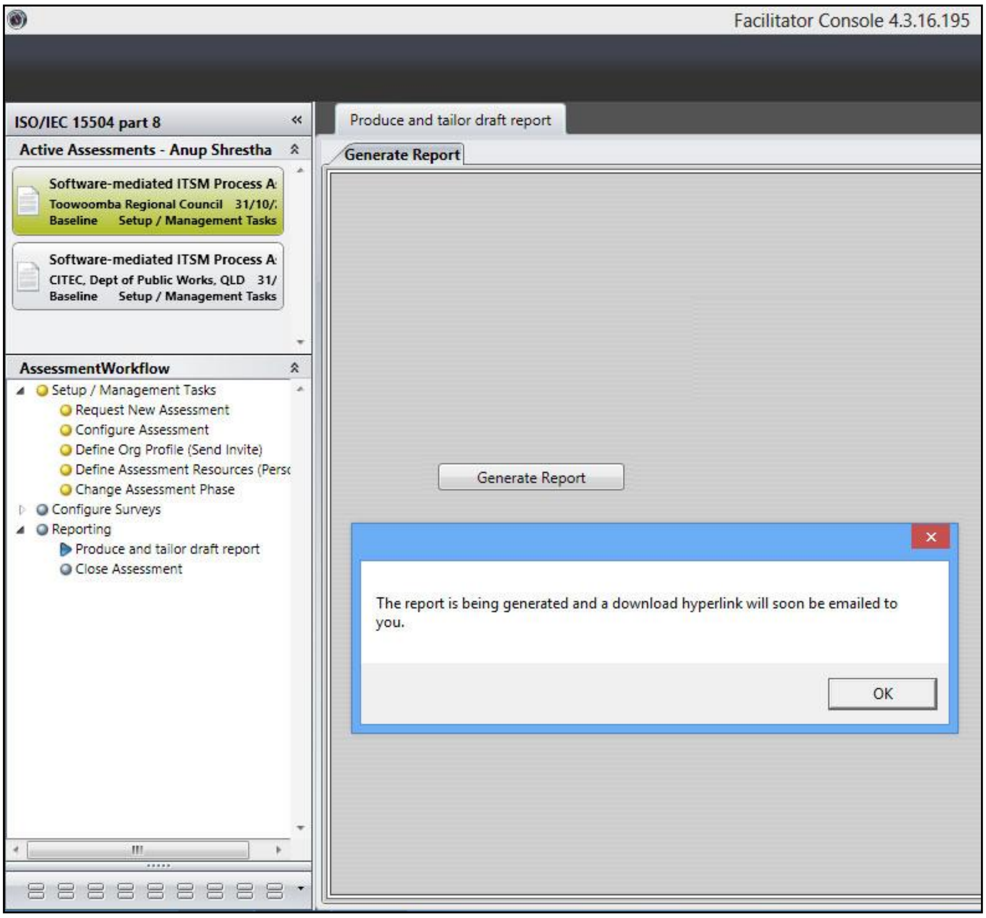

Figure 4.12 Screenshot of the DSS – Produce Assessment Report

Along with the process improvement recommendations derived from the knowledge base, the report also presents the standard indicator based on the PAM of the ISO/IEC 15504 standard that is associated with the question for which the recommendation is triggered. This allows traceability of the knowledge item to the specific process indicator where process risks were ascertained, a feature that is important to demonstrate alignment with the ISO/IEC 15504 standard. Likewise, the knowledge item score and the knowledge item reliability score are also presented alongside each knowledge item. A knowledge item corresponding to “High” reliability score suggests the recommendation should be strongly considered since the majority of the survey respondents confirmed the process risks associated with this recommendation item. In this way the DSS provides an objective method to present process improvement recommendations in the SMPA report.

The SMPA report generated by the DSS is not designed to be a turnkey solution. While knowledge items can be of assistance, processes cannot be improved solely by static knowledge items. However the SMPA report can provide process improvement guidelines where areas of process risk exist. In short, automation in the SMPA approach to generate an assessment report can contribute to a more efficient reporting activity facilitated by the information processing functionality of the DSS. In particular the level of granularity provided by the SMPA approach strongly supports its case of transparency and efficiency to conduct ITSM process assessments. The structure of the assessment report generated by the DSS is discussed next.

4.10.1 Structure of the Assessment Report

The SMPA report generated by the DSS has four sections. A paper-based prototype of the assessment report was initially built, showing a template of the report sections. A desk walkthrough was conducted, and the two ITSM practitioners (P1 and P2), one academic staff (A1) and this researcher reviewed and finalised the template and content of the report based on the information produced from the survey responses. The report template and how the report content is produced is detailed in Table 4.21.

Table 4.21 Assessment Report Template

Report Section	**Content Type**	**Content Description**
1.0 Introduction	Static text	Introduction information about the purpose of the report, processes selected to improve and SMPA approach undertaken
2.0 Organisation profile	Database driven text	A table of information about the organisation profile collected during Phase 1 Preparation of the SMPA approach
3.0 <PROCESS> introduction	Static text	For every process, the purpose and expected outcomes of the process as specified in ISO/IEC 20000 is reported
3.1 <PROCESS> assessment profile	Database driven text	For every process, the process attribute score and reliability score based on a template specified in Table 4.18 is reported
3.2 <PROCESS> improvement recommendation	Database driven text	For every process, relevant knowledge items from a knowledge base of ITIL guidelines is reported
4.0 Conclusion	Static text	Conclusion information about the process assessment approach and suggestions to start process improvement journey for CSI
Appendix A: Assessment Scope	Database driven text	The assessment scope in terms of the processes selected and the maximum capability level assessed for each process
Appendix B: SMPA approach	Static text	The SMPA approach followed for ITSM process assessment
Appendix C: Description of standard terminologies	Static text	A description of the standard terminologies used for the process capability levels and process attributes based on ISO/IEC 15504
Appendix D: PROCESS comments	Database driven text	Comments by survey participants
Appendix E: List of survey participants	Database driven text	A list of all assessment participants categorised by their roles as the assessment sponsor, assessment facilitator, process managers, process performers and/ or external process stakeholders

The first section, Introduction, provides a brief statement about the purpose of the report, processes selected for assessment and the organisational unit being assessed. In the second section, Organisation Profile, the report displays information captured about the organisation unit being assessed as recorded during Phase 1 Preparation. This section provides context for the assessment in terms of understanding the organisation where processes are being assessed.

In the third section, which is repeated for every process being assessed, the report includes a brief overview of the purpose and expected outcomes of the process according to ISO/IEC 20000 standard. Then the assessment profile for the process is presented based on the template provided in Table 4.18. Rationale of the calculations used during the assessment profile generation is provided. A breakdown of valid answers considered for the process attribute score (i.e. NPLF) against DnK and DnQ responses is also illustrated using a pie chart.

Process improvement recommendations are then presented in two tables. In the first table, all the knowledge items relating to PA1.1 (CL1); i.e. for base practices, are presented along with their knowledge item score and reliability score from all responses. This is possible because there is a one-to-one mapping of recommendation items for each assessment question. In the second table, recommendation items are presented for all generic practices of the process, i.e. from CL2 (PA2.1) to CL5 (PA5.2). These recommendations are extracted from the knowledge base only when any process area demonstrates significant risks, i.e. when the knowledge item score is either “Partially” (P) or “Not” (N).

In the final section, a conclusion is provided that reiterates the processes selected for assessment and the assessment approach. The conclusion section also states that the report should be used as a starting point in the process improvement journey for CSI and there is a need for the report to be contextualised based on the specific organisation profile. Hence the SMPA report must be discussed with key stakeholders and then modified based on organisation priorities and requirements before process improvements recommended by the report can commence.

The report is produced as a Microsoft Word document and therefore can be reviewed and edited by the assessment facilitator if required. A 15-page excerpt of the SMPA report is provided in **Appendix F.6** (p. 276). The SMPA report integrates the assessment workflow by combining the organisation profile, assessment profiles and process improvement recommendations as a single document. By including the organisation profile in the report, the assessor is presented with the organisational context in which the assessment was conducted. With a well-justified process assessment profile, a transparent method to determine process capability is provided. Finally, in line with the best practices from the ITIL framework, fine-grained and justified recommendations are provided for process improvement. These sections of the SMPA report have the potential to increase the utility of the report to process managers and assessors.

4.11 Artefact Demonstration

After a discussion of the method description and DSS implementation of the SMPA approach, the following section describes the demonstration step of the DSR methodology (Peffers et al. 2008). For each of the SMPA phases, the following sections describe the activities and results of the artefact demonstration at the two case study organisations.

4.11.1 Phase 1. Preparation

Based on the design principles established from the fit profile (Table 4.2), the DSS of the SMPA approach was demonstrated to facilitate assessment workflow and automate assessment activities at two case study organisations. The DSS platform was provided by the research partner AP. The DSS was developed in the Microsoft Azure cloud platform (Microsoft 2014) that enables building and managing applications which run through Microsoft-managed data centres.

4.11.1.1 Organisation Profile and Assessment Goals

Information about the organisation profile and assessment goals were collected from the two case study organisations during the first meeting with the assessment facilitator in May 2013, and later confirmed in October 2013 before being entered in the DSS. Information regarding the organisation profile and preliminary assessment information was also provided in the assessment report. **Appendix D.1** (p. 248) presents the pre-assessment planning form template that was used to collect relevant information for CITEC and TRC ICT. The information collected about the organisation profile for CITEC and TRC ICT was discussed in *sections 4.3.1* and *4.3.2*.

4.11.1.2 Process Selection

TRC ICT participated in the process selection method but CITEC declined citing staff workload issues. The assessment facilitator at CITEC acknowledged that selecting processes to improve lacks decision structure and is therefore an important area to consider in this project. However, she clarified her priorities and suggested that due to their current business climate, CITEC was more interested in the actual assessment outcomes for their chosen processes rather than evaluating a method to choose processes to improve.

CITEC provided a list of three processes to assess directly while TRC ICT implemented the process selection method as part of the SMPA approach and then selected the three processes recommended by the method. Hence the case demonstration for the process selection method provides details from a single case of TRC ICT only.

4.11.1.3 Determine Initial List of ITSM Processes. The 12 ITSM processes were confirmed to have been implemented in TRC ICT. Service managers at TRC ICT considered all 12 ITSM processes in the initial list of processes. There were no other processes considered.

4.11.1.4 Select Critical Business Drivers. The driver ranking exercise was implemented at TRC ICT. In total, 12 process stakeholders participated in the driver ranking exercise and contributed to the process scores. Stakeholders included four service provider managers, nine service provider employees and three service beneficiaries (customers). There are more roles (18) than participants (12) since some of the participants belonged to multiple ITSM stakeholder groups. The four business drivers selected were: (a) ITSM process excellence; (b) Meeting service level agreements from the “Internal Business Process” dimension; and (c) Quality in IT services; and (d) External customer satisfaction of IT services from the “External Customer” dimension. Based on the alignment rating of each of the 12 ITSM processes, the business driver score for each ITSM process was calculated by the DSS. These scores are presented later in Table 4.22.

4.11.1.5 Categorise Processes based on Service Gap Perception. The DSS was used at TRC ICT to conduct the service gap perception survey. Eleven process stakeholders across the three stakeholder groups (service beneficiary, service provider employee and service provider manager) participated in the survey. Survey results categorised by ITSM stakeholder groups along with the cumulative average scores for each service gap perception factor are illustrated as the IT service gap profile in Figure 4.13.

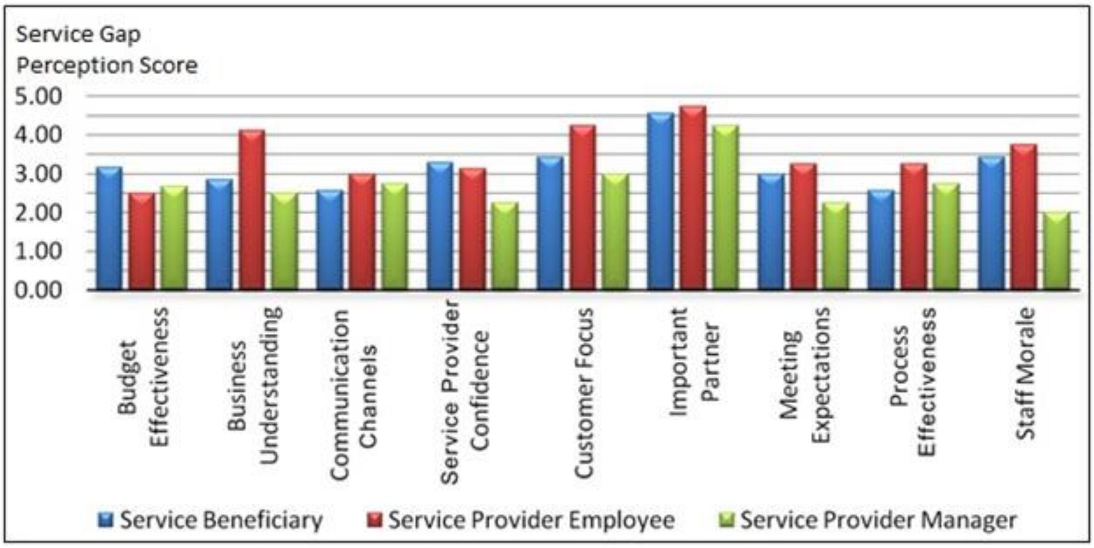

Figure 4.13 IT Service Gap Profile Based on the Perception Survey at TRC ICT

The IT service gap profile was presented to all eleven survey respondents and two other senior service managers in a process improvement workshop at TRC ICT in May 2013. The IT service gap profile was discussed intensively during the workshop. Many instances of constructive discussions were facilitated by the profile presented during the 2-hour workshop. A particularly interesting observation was the lengthy discussion as to why service employees largely felt that they serve business well while service beneficiary and service provider managers are neutral or disagree ("Business Understanding" score in the IT service gap profile in Figure 4.13). Discussions led to a conclusion that the "Service Level Management" process was critically deficient and needed improvement. This observation is an example of how service gap perceptions shape discussions to decide ITSM processes that need improvement.

All workshop attendees were also presented with a process information sheet that defined all 12 ITSM processes with their purposes and expected outcomes as outlined in the PRM from ISO/IEC 20000 (ISO/IEC 2010). This information sheet and discussions that arose based on the IT service profile gap facilitated the grouping of the ITSM processes in terms of their relative importance to improve. The DSS was used to categorise the processes based on consensus. The final grouping of ITSM processes based on their relative importance for improvement is illustrated in the DSS screenshot in Figure 4.14.

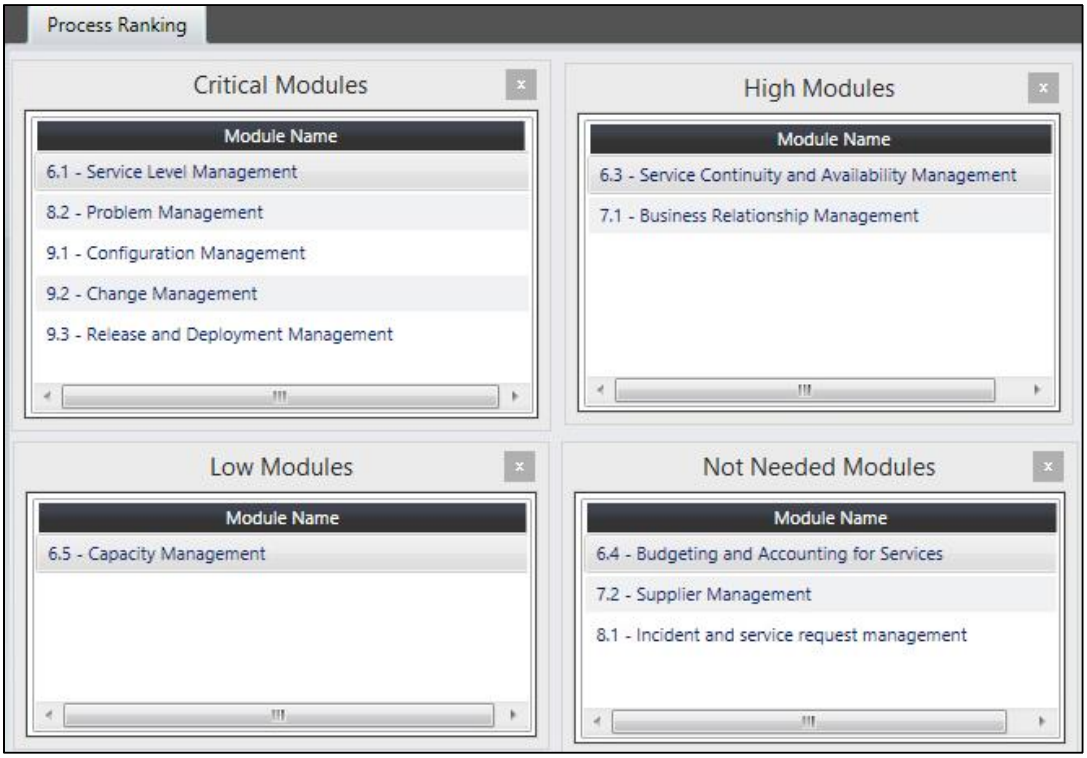

Figure 4.14 DSS screenshot – Service Gap Perception Ranking
(Note: "modules" in the DSS refers to ITSM processes)

4.11.1.6 Produce a Process Selection Matrix. The two scores: Business Driver Score; and Service Gap Perception score, calculated by the process selection module of the DSS at TRC ICT is listed in Table 4.22.

Table 4.22 Business Driver Score and Service Gap Perception Score

ITSM process (from ISO/IEC 20000)	**Business driver score (0 - 16)**	**Service gap perception score (0 - 4)**
6.1 Service Level Management (6.1 SLM)	11	4
6.3 Service Continuity and Availability Management (6.3 SCAM)	12	3
6.4 Budgeting & Accounting for Services (6.4 BAS)	5	0
6.5 Capacity Management (6.5 CaM)	9	1
6.6 Information Security Management (6.6 ISM)	7	2
7.1 Business Relationship Management (7.1 BRM)	11	3
7.2 Supplier Management (7.2 SM)	7	0
8.1 Incident and Service Request Management (8.1 ISRM)	12	0
8.2 Problem Management (8.2 PM)	13	4
9.1 Configuration Management (9.1 CoM)	6	4
9.2 Change Management (9.2 ChM)	10	4
9.3 Release and Deployment Management (9.3 RDM)	13	4

A process selection matrix was generated for TRC ICT using the DSS and is illustrated in Figure 4.15. Six ITSM processes were plotted in quadrant I, one in quadrant II, two in quadrant III and three in quadrant IV. The matrix in Figure 4.15 was presented at TRC ICT to four senior IT managers who have authority to make decisions regarding selection of the processes for the process improvement project. The matrix aided their decisions and they selected four of the six processes from quadrant I for process improvement. The four processes selected were Service Level Management (6.1 SLM), Problem Management (8.2 PM), Change Management (9.2 ChM) and Release and Deployment Management (9.3 RDM). Two other processes were rejected on the grounds of resource constraints.

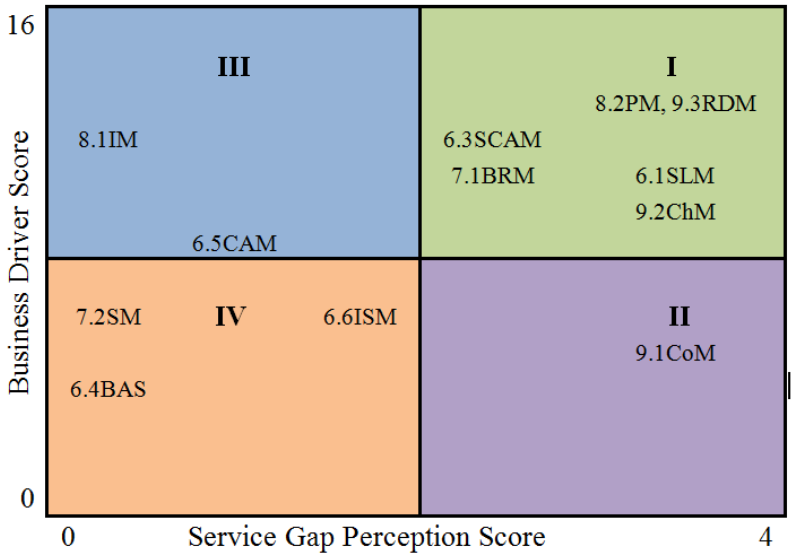

Figure 4.15 Process Selection Matrix at TRC ICT

It is demonstrated from this case that the process selection matrix helped IT service managers make informed choices regarding their decisions to select ITSM processes to improve. Chapter 5 presents more details on the evaluation results of the process selection method in the SMPA approach.

4.11.1.7 Process Role Allocation

The details of assessment participants were loaded in the facilitator console of the DSS and their process roles were specified. The online surveys were automatically allocated based on the process roles since questions were already associated with process roles. Since every assessment question is associated with at least one process role, when the process roles were determined for each survey participant, it meant that the questions for the survey could be compiled for each participant. A maximum of three surveys could be allocated to each participant if they assumed a role in each of the three processes assessed at each organisation.

The process role allocation details at CITEC and TRC ICT are presented in Table 4.23. There were 11 participants at TRC ICT whereas 13 process stakeholders participated in the assessment survey at CITEC.

Table 4.23 Process Role Allocation at CITEC and TRC

ITSM Process \ Process Role	Case Study Organisation					
	CITEC (13)			TRC ICT (11)		
	PM	PP	EPS	PM	PP	EPS
6.1 Service Level Management	1	2	2	N/A	N/A	N/A
8.2 Problem Management	1	2	1	2	5	3
9.1 Configuration Management	1	2	2	1	4	4
9.2 Change Management	N/A	N/A	N/A	2	4	3

Table 4.23 illustrates significant differences in the way the two case organisations operate. There were only 14 process roles distributed among 13 staff for the three processes at CITEC. This meant almost every staff member had dedicated process roles to work on. There was only one staff member who had two roles and therefore two surveys to complete. All other staff at CITEC had only one survey to complete that corresponds to their role in the ITSM process.

In sharp contrast, TRC ICT had 28 process roles distributed among 11 staff for the three processes. This suggests that almost every staff member plays multiple roles in undertaking process activities at TRC ICT. There was only one staff that had a single role. Four staff undertook the performer role for all three processes suggesting staff did not have a clear process-oriented structure in their activities. There was also one staff member who was the process manager for all three processes. Moreover, one staff was the external process stakeholder for all three processes.

4.11.2 Phase 2. Survey

The number of questions in each survey was determined by the maximum capability level that each case study organisation selected to assess their processes. In this research, it was intended to go to the maximum process capability level 5 so that all the questions in the SMPA approach could be trialled for research purposes. Both the case organisations did not expect to reach to CL5, however TRC ICT agreed to perform assessments up to CL5 for evaluation purposes. CITEC on the other hand scoped their assessment to CL4 only.

One staff member at each case study organisation was nominated as the assessment facilitator who is responsible to ensure all participants have completed their surveys. The assessment facilitator would also ease communication by acting as a single point of contact to coordinate all assessment activities. With the help from the assessment facilitator, the SMPA approach facilitated by a DSS collected assessment data from online surveys.

Table 4.24 presents the number of questions that applied to survey participants in different roles for the three relevant processes at CITEC and TRC ICT. The number of questions is larger at TRC ICT because of the inclusion of CL5 questions. The number of questions for each role ranged from 32 to 131: the external process stakeholder role in the Service Level Management process received 32 questions while the process manager role in Configuration Management process was allocated 131 questions.

Table 4.24 Total Number of Questions per Process for each Role at CITEC and TRC ICT

ITSM Process \ Process Role	Case Study Organisation					
	CITEC (CL4)			TRC ICT (CL5)		
	PM	PP	EPS	PM	PP	EPS
6.1 Service Level Management	98	87	32	N/A	N/A	N/A
8.2 Problem Management	99	89	34	130	105	41
9.1 Configuration Management	100	90	35	131	106	42
9.2 Change Management	N/A	N/A	N/A	130	108	44

An email was sent to all survey participants using the DSS with a link to the assessment survey on 11 October 2013. The format of the online survey email is included in **Appendix D.4** (p. 251). The survey was accessed by respondents from web browsers on their computers. The survey participants were assured of confidentiality and freedom to withdraw from the assessment survey at any time.

The facilitator console of the DSS was used to track the progress of all survey participants. Progress updates were emailed to the assessment facilitators on a weekly basis. This enabled the assessment facilitator to follow up any participants who made little progress in the survey. The survey interface has a feature to pause at any time and every response on every page is recorded in real time. When a participant clicked the survey link at a later date, it would resume at the point where they had left from their last session.

The assessment survey was open from 11 October 2013 to 25 October 2013 at both organisations. TRC ICT requested a one week extension for staff to complete multiple surveys. With the help and support from the assessment facilitators and assistance from the survey tracking functionality of the DSS, assessment data collection using surveys was completed by 5 November 2013.

Comments provided during the assessment survey were captured. Table 4.25 lists the number of comments for each process at each site. Comments from survey participants provided a rich source of qualitative information about process capabilities; interpretation of survey questions and responses; discussions regarding process strengths, weaknesses, opportunities and threats; and contextual information about the organisation, related processes, people issues, technology factors and constraints.

Table 4.25 Number of Comments provided during Survey at CITEC and TRC ICT

ITSM Process	CITEC	TRC ICT
6.1 Service Level Management	0	N/A
8.2 Problem Management	31	25
9.1 Configuration Management	42	1
9.2 Change Management	N/A	20
TOTAL	**73**	**46**

4.11.3 Phase 3. Measurement

At CITEC, the assessment profile generated for the three processes selected for assessment is displayed in Table 4.26.

Table 4.26 Assessment Profile for Three Processes at CITEC

	Level 1	**Level 2**		**Level 3**		**Level 4**		**Level 5**	
Profile	PA1.1	PA2.1	PA2.2	PA3.1	PA3.2	PA4.1	PA4.2	PA5.1	PA5.2
PROBLEM MANAGEMENT									
Process attribute score	L	L	L	L	L	L	P	N/A	N/A
Reliability score	High	High	High	High	High	Moderate	Poor		
Number of responses	4	4	4	4	4	4	4		
SERVICE LEVEL MANAGEMENT									
Process attribute score	L	L	L	L	L	P	L	N/A	N/A
Reliability score	High	High	High	High	High	Moderate	High		
Number of responses	5	5	5	5	5	5	5		
CONFIGURATION MANAGEMENT									
Process attribute score	L	L	L	L	L	L	F	N/A	N/A
Reliability score	High	High	High	High	High	High	High		
Number of responses	5	5	5	5	5	5	5		

Since all processes assessed at CITEC had a process attribute score of “Largely” (L) at PA1.1, the three processes achieved CL1 according to the ISO/IEC 15504 standard. The purpose of the assessment profile in Table 4.26 is to demonstrate gaps in process capabilities and therefore suggest process improvement recommendations. Almost all of the rating scores for all processes at CITEC demonstrated a “High” reliability score (18 “High”, two “Moderate” and only one “Poor” reliability score). This means that survey respondents were consistent in their answers. Moreover, most of the rating scores were “Largely” (L). There were two “Partially” (P) and only a single “Fully” (F) rating score at different process attributes. This demonstrates consistently high process capability scores for the three processes assessed at CITEC.

At TRC ICT, the assessment profile generated for the three processes selected for assessment is provided in Table 4.27.

Since only one process assessed at TRC ICT, Problem Management, had a rating score of “Largely” (L) at PA1.1, this process achieved CL1 according to the ISO/IEC 15504 standard. The other two processes were “Partially” (P) at PA1.1 suggesting that they are at CL0 according to the normative assessment framework. The majority of the rating scores for all processes at TRC ICT demonstrated a weak reliability score (six “Poor”, 18 “Moderate” and only three “High” reliability score). This meant that survey respondents were not consistent in their answers and responses were varied. Moreover, most of the rating scores were "Partially" (P). There were two “Largely” (L), only a single “Not” (N) and none of the rating score achieved “Fully” (F) at any of the process attributes. This demonstrates relatively meagre process capability levels for the three processes assessed at TRC ICT.

Table 4.27 Assessment Profile for Three Processes at TRC ICT

	Level 1	Level 2		Level 3		Level 4		Level 5	
Profile	PA1.1	PA2.1	PA2.2	PA3.1	PA3.2	PA4.1	PA4.2	PA5.1	PA5.2
PROBLEM MANAGEMENT									
Process attribute score	L	P	P	P	P	P	N	P	P
Reliability score	High	Moderate	Poor	Poor	Moderate	Moderate	Moderate	Moderate	Moderate
Number of responses	10	10	10	10	10	10	10	10	10
CHANGE MANAGEMENT									
Process attribute score	P	P	P	P	L	P	P	P	P
Reliability score	Moderate	Moderate	Moderate	Poor	High	Moderate	Moderate	Moderate	Moderate
Number of responses	9	9	9	9	9	9	9	9	9
CONFIGURATION MANAGEMENT									
Process attribute score	P	P	P	P	P	P	P	P	P
Reliability score	Poor	Moderate	Poor	Poor	High	Moderate	Moderate	Moderate	Moderate
Number of responses	10	9	9	9	9	9	9	9	9

4.11.4 Phase 4. Improvement

In order to comply with the ethics guidelines for this research, the comments provided by survey participants, that were originally exported "as is" in the report, were reviewed. If the comments were potentially identifying individuals in the organisation, such sections of the comments were removed. The final version of the SMPA report was emailed as a portable document format (PDF) attachment on 5 December 2013 to the assessment facilitators at CITEC and TRC ICT. A follow up call was made on 10 December 2013 to determine if the assessment facilitators had received and reviewed the assessment reports, and if they had discussed the report with the process managers for process improvements. This confirmation enabled this researcher to plan for the evaluation of the SMPA approach.

Table 4.28 lists the total number of process improvement knowledge items that were embedded as recommendations in the assessment reports sent to CITEC and TRC ICT. Based on the assessment profiles in Table 4.26 for CITEC and Table 4.27 for TRC ICT, it is not surprising that TRC ICT had a significantly larger number of process improvement recommendations than CITEC. Besides the comparatively lower process capability scores at TRC ICT, another factor that contributed to larger number of recommendations at TRC ICT is the fact that assessment of all the processes was undertaken up to CL5.

Table 4.28 Number of Knowledge Items in the Assessment Report at CITEC and TRC ICT

	Case Study Organisation					
	CITEC (CL4)			TRC ICT (CL5)		
Process Attribute \ ITSM Process	**PrM**	**CoM**	**SlM**	**PrM**	**CoM**	**ChM**
PA1.1 Process Performance	1	1	1	1	10	9
PA2.1 Performance Management	7	5	8	17	20	17
PA2.2 Work Product Management	0	0	2	10	12	11
PA3.1 Process Definition	4	0	5	8	10	6
PA3.2 Process Deployment	2	0	2	6	10	4
PA4.1 Process Measurement	5	0	9	13	14	14
PA4.2 Process Control	10	0	2	11	11	11
PA5.1 Process Innovation	N/A	N/A	N/A	14	15	15
PA5.2 Process Optimisation	N/A	N/A	N/A	11	11	10
TOTAL	**29**	**6**	**29**	**91**	**113**	**97**

At PA1.1, all recommendation items are presented in the assessment report regardless of the process rating score. From PA2.1 onwards, the recommendation items are presented in the assessment report only when the process rating score is “Partially” (P) or “Not” (N). The intended target audience of the SMPA reports – relevant process managers – were expected to review the process improvement recommendations and consider them for further improvements of their respective processes. The SMPA approach facilitated by the DSS provided a transparent and efficient mechanism to recommend process improvements in a fine-grained scale that associated each process improvement recommendation to a specific assessment question.

4.12 Chapter Summary

The lack of transparency and the need for efficiency are recognised as two significant challenges for ITSM process assessments. To address these problems, the SMPA approach was developed to assist organisations to self-assess their ITSM processes repeatedly using a standard model.

The SMPA approach uses a DSS that has four main areas of functionality: a process selection method; online survey for assessment questions; logic for calculation of process capability scores; and generation of process improvement recommendations from a knowledge base. This chapter focused on the artefact design and development process, i.e. the “design” aspect of the DSR project. Since a DSR project must focus on the research artefact (Hevner et al. 2004), this chapter provided a detailed description of the SMPA approach. All four phases of the SMPA approach are designed to work in an efficient and transparent manner to enable CSI through repeated self-assessments. Several cycles of formative evaluations were conducted during the design and development of the SMPA approach as discussed in this chapter.

The SMPA approach was trialled at two case study organisations: CITEC and TRC ICT. During the artefact demonstration, the process selection method was conducted at TRC ICT only while the other phases of the SMPA approach were trialled at both organisations. Three ITSM processes were assessed at each organisation. The assessment profiles provided in the assessment report illustrated higher process capability levels for all processes at CITEC than the processes at TRC ICT.

Following the trial implementation of the SMPA approach as reported in this chapter, the usability of the SMPA approach and the expected decision quality from the use of the SMPA report by process managers can be evaluated. On this note, the thesis proceeds with a description of the summative evaluation that took place to determine the usability of the research artefact in Chapter 5 Artefact Evaluation.

Chapter 5. Artefact Evaluation

5.1 Chapter Introduction

Chapter 4 described the artefact design, development and demonstration phases and the artefact was presented as the SMPA approach. This chapter presents the evaluation of the artefact and research design process, thereby reporting the research outcome from the trials at two organisations. In terms of the research methodology described in Chapter 3, DSR projects require an evaluation phase in order to determine the effectiveness of the artefact (Hevner et al. 2004). Evaluation answers the question: “how well the artefact performs?” (March & Smith 1995, p. 254). Using the TTF theory, design principles from a fit profile have been used for the development of the artefact. However evaluation of the fit for performance is required to review the utility of the research artefact.

This chapter reports the utility of the SMPA approach in terms of the usability of the underlying DSS supporting the approach. TTF theory suggests performance improvement as an indicator of a fit between task and technology (Zigurs & Buckland 1998). The fit profile was discussed in Chapter 4. Evaluation of the performance of the fit profile in terms of the design process (research design) and the design product (SMPA approach) are discussed in this chapter. The usability of the DSS was examined at each of the four phases of the SMPA approach. Likewise, research design evaluation was primarily conducted using established theories and guidelines in an artificial setting.

This section presented the chapter introduction. *Section 5.2* presents the evaluation strategy. An evaluation of the usability of the DSS to determine effectiveness, efficiency and satisfaction of using the underlying SMPA approach (design product evaluation) is discussed in *section 5.3*. The quality of the entire research process (design process evaluation) is evaluated and discussed in *section 5.4*. Finally, *section 5.5* presents the chapter summary and provides key findings from the evaluation.

Figure 5.1 gives an overview of this chapter in terms of evaluation strategy and protocols used.

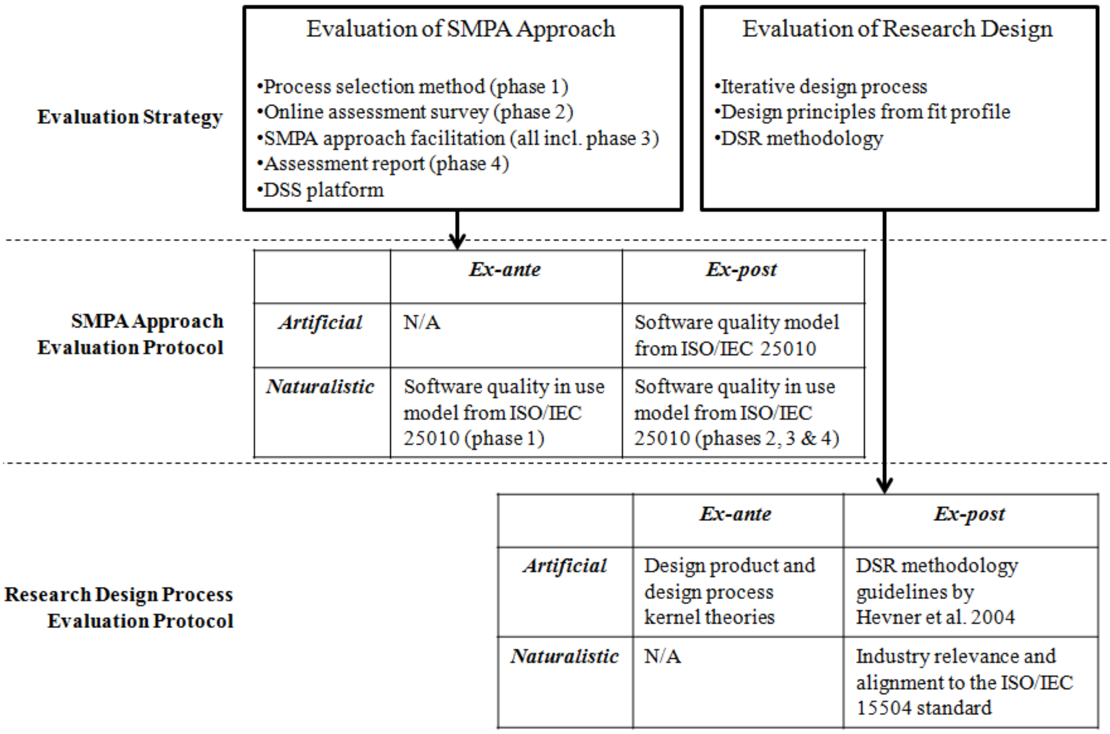

Figure 5.1 Chapter 5 Overview

5.2 Evaluation Strategy

In order to conduct a thorough evaluation, an evaluation strategy advocated by Pries-Heje, Baskerville and Venable (2008) was developed. Following the IS design theory discussed in Chapter 3, *section 3.3.1*, the evaluation strategy separates the evaluation of the design product i.e. the SMPA approach, from the design process i.e. research design. Two evaluation settings considered in the evaluation strategy are the timing of the evaluation (*ex-ante* or *ex-post*) and the setting of the evaluation (artificial or naturalistic). Table 5.1 presents the strategic DSR evaluation framework proposed by Pries-Heje, Baskerville and Venable (2008).

Table 5.1 DSR Evaluation Framework by Pries-Heje, Baskerville and Venable (2008)

Setting	*Ex-Ante*	*Ex-Post*
Naturalistic	Design Process / Design Product	Design Process / Design Product
Artificial	Design Process / Design Product	Design Process / Design Product

Pries-Heje, Baskerville and Venable (2008) suggested at least two evaluation episodes: “design-evaluate-construct-evaluate”. *Ex-ante* evaluation occurs before and during artefact design and development with the application of kernel theories in the design process and the final artefact. *Ex-ante* evaluation has already been discussed in Chapter 4 as part of the iterative design process that included build-evaluate cycles. Therefore *ex-ante* evaluation is only presented briefly in this chapter.

Likewise, in an artificial setting, the kernel theories used for the development were also used in the evaluation of the SMPA artefact and research design. Naturalistic evaluation, on the other hand, assesses the application of the artefact and design process in a real-world setting (Peffers et al. 2012). Case study research was undertaken for naturalistic evaluation of the SMPA approach in this research.

Qualitative evaluation was conducted at two case study organisations. The concept of usability as defined in ISO/IEC 25010 software quality in use model was applied to evaluate the effectiveness, efficiency and satisfaction of using the DSS in the SMPA approach. Moreover the DSS platform used for the SMPA approach was evaluated based on the software quality model defined in ISO/IEC 25010 (ISO/IEC 2011a).

Maintaining privacy of the individuals that participated in this research is an ethical consideration discussed in Chapter 3, *section 3.6*. Therefore research participants have not been identified with their names. The two case study organisations are referred to as *C* for CITEC and *T* for TRC ICT. Each individual's most relevant process and role are used for reference purposes. Besides the three process roles of process manager, process performer and external process stakeholder, two assessment roles and two service roles are used to refer to individuals. Codes used to refer to individuals who participated in the evaluation are listed in Table 5.2.

Table 5.2 Codes to Refer to Case Study Participants

Code	Reference	Reference type
T	TRC ICT	Case Study Organisation
C	CITEC	Case Study Organisation
PrM	Problem Management	Process
ChM	Change Management	Process
CoM	Configuration Management	Process
SlM	Service Level Management	Process
PM	Process Manager	Process Role
PP	Process Performer	Process Role
EPS	External Process Stakeholder	Process Role
SM	Service Manager	IT Service Role
SB	Service Beneficiary (internal customer)	IT Service Role
AF	Assessment Facilitator	Assessment Role
AS	Assessment Sponsor	Assessment Role

To provide an example based on Table 5.2, a direct quote from participant *T-PrM-EPS1* indicates that the comment is from the TRC ICT case (T) by one of the external process stakeholders (EPS1) of the Problem Management (PrM) process.

5.2.1 Evaluation Strategies for SMPA Approach

Three user types of the DSS who are involved in the SMPA approach with their typical roles were described in Chapter 4, Table 4.5. Staff belonging to one of the user types – process stakeholder, assessment facilitator or process manager – were interviewed for the evaluation of the DSS. Since different user types had different contexts of use of the DSS, they participated in evaluation separately at different times. The context of use of the DSS at each phase of the SMPA approach determines the user's unique goals to use DSS. Table 5.3 presents evaluation strategies in terms of the context of use for DSS user types to evaluate the SMPA approach.

Table 5.3 Evaluation Strategies for DSS User Types Based on their Context of Use

Evaluation focus	**User type**	**Context of use**	**SMPA approach**
Process selection method	Process stakeholder	Decision-making to select critical processes to improve	Phase 1 Preparation
Online assessment survey		Representative and understandable assessment questions to answer	Phase 2 Survey
SMPA approach facilitation	Assessment facilitator	Transparency and efficiency in assessment workflow and automation	All, primarily Phase 3 Measurement
SMPA report	Process manager	Decision-making to improve ITSM processes	Phase 4 Improvement
DSS platform	All users	Use of an appropriate platform to execute the SMPA approach	All

Excluding the *ex-ante* evaluation of the process selection method (Phase 1 Preparation), the evaluations of other phases of the SMPA approach are all *ex-post* and based on data from focus group discussions and semi-structured interviews at each case study organisation. The case study participants commented on the usability of the DSS based on their context of use. The data were analysed by reviewing discussion and interview transcripts for themes or patterns related to five software quality in use characteristics defined in ISO/IEC 25010: effectiveness; efficiency; usefulness; trust; and comfort. The standard definitions of the five software quality characteristics were transformed into operational definitions of usability characteristics to align their meaning to specific contexts of use.

For each organisation, the usability of the SMPA approach in terms of the use of DSS is summarised and presented in a tabular form using the operational definitions of software quality characteristics. The use of a matrix to analyse qualitative evaluation factors has been reported as a useful approach in case study research (Huberman & Miles 1994; Yin 2009). In order to present the SMPA approach as a valid contribution to the body of knowledge, it is essential to ensure that the SMPA approach is usable. Therefore, usability evaluations are presented as the primary source of information to answer RQ2 and RQ3 in this research.

5.2.2 Evaluation Strategies for Research Design Process

The use of TTF theory as a major kernel theory justified the design process in this research. Following TTF theory for DSS technology dimensions and a fit profile represent an *ex-ante* artificial setting evaluation that continuously took place during the artefact development process with several iterations of updates (Pries-Heje, Baskerville & Venable 2008). Moreover the use of seven other kernel theories during the development of the SMPA approach as discussed in Chapter 3, *section 3.3* demonstrates rigour in the research design process and serves as evaluation checkpoints for the articulation of the research artefact.

Likewise, interviews with two experts in the research team – P1 and S1 – were conducted to evaluate the design principles from the fit profile in terms of industry relevance and alignment to the international standard for process assessment ISO/IEC 15504. The DSR guidelines proposed by Hevner et al. (2004) were followed for the *ex-post* evaluation of the entire research process. Table 5.4 presents evaluation strategies in terms of the scope and context specified for evaluation of the research design.

Table 5.4 Evaluation Strategies for the Research Design

Evaluation focus	**Scope**	**Context**
Iterative design process	Design and development of the SMPA approach	Use of kernel theories to support and justify the design process
Design principles from the fit profile	Utility and validity of the design principles	Opinion of P1 and S1 on the use of the design principles based on industry relevance and alignment to the ISO/IEC 15504 standard
DSR methodology	Entire research project	Use of established DSR guidelines to conduct the research project

The evaluation strategies were operationalised using two protocols – one for design product evaluation and another for design process evaluation. The two protocols are discussed in detail in the following two sections.

5.3 Design Product Evaluation

The *ex-post* evaluation in a natural setting was conducted as qualitative case study research. This research was transformed from an iterative design process that had multiple cycles of formative evaluations into a case study research for summative evaluations in order to determine the utility of the SMPA approach, akin to performance evaluation of fit in the TTF theory. This evaluation attempts to assess if the SMPA approach can contribute to more transparent and efficient ITSM process assessments. Table 5.5 presents the evaluation protocol for the design product, i.e. the SMPA approach, which is discussed next.

Table 5.5 Evaluation Protocol for Design Product Evaluation

SMPA phase	**Evaluation setting (Time, Type)**	**Evaluation focus (What is evaluated)**	**Evaluation method (How it is evaluated)**	**Evaluation instrument**	**Evaluation site**
Phase 1 Preparation (Input)	*Ex-ante*, Natural	Process selection method	Interview with Service managers and service beneficiaries	Quality in use model from ISO/IEC 25010	TRC ICT
Phase 2 Survey (Input)	*Ex-post*, Natural	Online assessment survey	Focus group discussion with survey respondents	Quality in use model from ISO/IEC 25010	CITEC & TRC ICT
All, primarily Phase 3 Measurement (Processing)	*Ex-post*, Natural	SMPA approach facilitation	Interview with assessment facilitators	Quality in use model from ISO/IEC 25010	CITEC & TRC ICT
Phase 4 Improvement (Output)	*Ex-post*, Natural	Assessment report	Interview with process managers	Quality in use model from ISO/IEC 25010	CITEC & TRC ICT
All	*Ex-post*, Artificial	DSS platform	Alignment with quality attributes	Quality model from ISO/IEC 25010	CITEC & TRC ICT

5.3.1 Evaluation of Process Selection Method

Even though the evaluation of the process selection method was conducted after its development, it was an early stage development of the entire SMPA approach. The process selection method is a pre-requisite to define the scope of the processes in order to develop assessment questions and process improvement knowledge items. Therefore, this evaluation is considered an *ex-ante*, naturalistic evaluation for this research.

Only TRC ICT participated in the process selection method. The process selection method was evaluated by obtaining experience feedback on the usability of the process selection method. The operational definitions of four usability characteristics that were used for the evaluation of the process selection method are provided in Table 5.6. **Appendix F.2** (p. 264) presents the interview questions that are aligned with the usability characteristics, along with an interview protocol, used during the evaluation.

Table 5.6 Operational Definitions of Usability Characteristics used to evaluate Process Selection Method

Usability characteristic	**Operational definition**
Effectiveness	**Accuracy and transparency** of the process selection method
Efficiency	**Time, cost and resources** required for the process selection method
Usefulness	**Perceived utility** of the process selection method
Trust	Confidence in the **validity** of the process selection method

5.3.1.1 Evaluation of Process Selection Method at TRC ICT

Four process stakeholders – two service managers and two service beneficiaries – were interviewed at TRC ICT to evaluate the usability of the process selection method. The interview notes were taken and later emailed to confirm the accuracy of the interview data. This evaluation was undertaken with active support from the assessment facilitator at TRC ICT (*T-AF*). Feedback from the two service managers, coded as *T-SM1* and *T-SM2* and two service beneficiaries, coded as *T-SB1* and *T-SB2* was extremely positive regarding the usability of the process selection method as presented in Table 5.7. TRC ICT adopted the method and initiated their service improvement project by selecting critical processes as recommended by the process selection method.

Table 5.7 Evaluation Results of Process Selection Method at TRC ICT

Usability characteristic	**Case evidence (4 participants)**	**Selected key comments**
Effectiveness	☑☑☑⦿	**T-SM1:** … does its job accurately… **T-SM2:** … use of balanced scorecard and the service quality model makes the selection transparent … **T-SB1:** …. [capability to] ask more people…
Efficiency	☑☑⦿⦿	**T-SM1:** … making efficient use of software [DSS] in decision-making… **T-SM2:** … time well spent … ease of using online surveys ...
Usefulness	☑☑☑☑	**T-SM1:** … areas of improvement can be identified… **T-SM2:** …made our meeting rather more productive… **T-SB1:**…evidence-based decision-making…, …can ask more people [scalable]…, democratic **T-SB2:** easy to interpret…decision support by using the process selection matrix…
Trust	☑☑☑⦿	**T-SM1:** … dependable approach … **T-SM2:** … based on balanced scorecard and service quality… **T-SB1:** … more truthful answers…

☑ indicates the usability characteristic was strongly supported by a participant
⦿ indicates the usability characteristic was not clear or a neutral position was taken by a participant
☒ indicates the usability characteristic was strongly opposed by a participant

Qualitative analysis of the interview notes confirmed the positive usability of the process selection method. All service managers and service beneficiaries said that the method is very reassuring and will affirm their process selection decisions.

All participants found the method useful to examine and understand priorities in ITSM processes. Regarding trust in the process selection method, there was strong support that the decisions made based on the process selection method are valid and dependable. All interviewees indicated the process selection method appeared to be valid—in other words, to have a strong face validity (Trochim & Donnelly 2008). For example:

> *"I think it is dependable and does its job accurately; this approach will identify which processes satisfy our vision and where our service quality shortfalls exist. From this information, areas for improvement can be identified by making good use of your software." (T-SM1)*

The use of the Balanced Scorecard and SERVQUAL model reinforced the validity of the process selection method. The participants seemed especially interested in the ability to survey process stakeholders using the Balanced Scorecard and SERVQUAL archetypes:

> *"If your tool contrasts processes based on the [balanced] scorecard and service quality [SERV-QUAL model], these are used extensively worldwide. I am sure this allows our processes to be prioritised for improvements looking at business importance and process gaps." (T-SM2)*

The presentation of the IT service gap profile and process selection matrix impressed one service beneficiary in particular, who makes decisions to authorise process improvement projects:

> *"It is always easy to interpret visual format to identify where our deficiencies exist … your chart [process selection matrix] can identify the priority with which each process should be improved." (T-SB2)*

Even though using a DSS to select processes has a time imposition in contrast to a quick meeting to decide which processes should be selected for improvement, efficiency in terms of time, cost and resource requirements was endorsed during evaluation. The DSS appeared to be useful to ensure that resources are well spent on the process improvement initiatives. None of the interviewees thought following the proposed method using a DSS was a waste of time. For example:

> *"No, it's time well spent. Surveys are easy to use … they [driver ranking and service perception surveys] enable collecting information without having to arrange several meetings, etc. When we do need to decide on selecting processes, this tool has guided us. I think the tool made our meeting rather more productive." (T-SM2)*

All interviewees thought the process is transparent and accurate when the DSS was used. One service beneficiary commented that the use of the process selection matrix provided a more "democratic" approach where all relevant staff had a say in improvement priorities. He suggested this will ensure that process improvements will be readily supported since everyone discussed this from the beginning. He expressed his views on the effectiveness of the DSS in terms of accuracy and transparency:

> *"Your tool gives more truthful answers about our organisation. You can ask more people [about] improvement priorities, scorecard [business drivers], etc. I am impressed how your software [DSS] assists in making decisions based on evidence to select [processes to improve]." (T-SB1)*

In general, the process selection method had positive usability characteristics as seen in the participants' comments attesting to its ability to assist in decision-making. The outputs also appeared to have strong reliability as seen in the corroboration of findings from the case evidence and academic literature of kernel theories such as the Balanced Scorecard and the SERVQUAL model. The process selection method was seen to be valuable to support initial communication regarding improvement initiatives of ITSM processes.

5.3.2 Manual ITSM Process Assessment

To evaluate the process and outcome of the SMPA approach, a conventional ISO/IEC 15504 compliant process assessment, hereafter referred to as "manual assessment", was conducted to compare the SMPA approach with a standard ITSM process assessment method. This is particularly important since both case study organisations reported no previous experience in formal ITSM process assessments.

For manual assessment, CITEC agreed to assess the three processes that they chose for the SMPA approach. For TRC ICT, five closely associated ITSM processes were assessed during the manual assessment that included the four processes selected for the SMPA approach. The fifth process was Service Planning. For both organisations, the scope of the one-day manual assessment was to assess the ITSM processes up to CL3 only. The manual assessment was conducted on-site at the case study organisations with active support from the assessment facilitators using a standards-compliant RAPID methodology for process assessments (Cater-Steel, Toleman & Rout 2006).

The manual assessment was conducted by a panel of three assessors including this researcher. The assessment team was led by a certified ISO/IEC 15504 expert (S1) who has the authority to conduct assessment and provide an assessment report compliant with the international standard requirements of ISO/IEC 15504-2. The second assessor (A1) is also a certified ISO/IEC 15504 assessor with an established research profile in the areas of ITSM and process assessments. This researcher was the third assessor to assist in assessment data collection by asking probing questions during the assessment interviews, recording notes and suggesting recommendations for the assessment report. However this researcher did not participate in the final judgment of the process capability levels due to two primary reasons. Firstly, this researcher is not a certified assessor and was involved in the exercise primarily as a support personnel. Secondly, active involvement of this researcher in process capability determination may introduce bias during the evaluation of the SMPA approach in comparison with the manual assessment.

A brief overview of the manual assessment that was conducted at CITEC and TRC ICT is provided next. The assessment was divided into four phases throughout the day: Assessment kick-off; Data collection; Team consensus session; and Feedback and closure. A typical schedule of activities that was followed during the two manual assessments at CITEC and TRC ICT is listed in **Appendix F.1** (p. 263).

All process stakeholders belonging to a particular process were invited to discuss their process activities during appropriate sessions. The RAPID assessment instrument included standard indicators for assessment. It was used to probe questions and guide discussions with the process stakeholders. Notes were taken during the assessment by all assessors. At the end of each session, the assessment team discussed key observations and notes taken during the assessment.

After the interview sessions, the assessment team convened to arrive at consensus on the findings and ratings for the assessment. The assessment team summarised the consensus reached on process ratings and identified the key proposed actions. At the end of the consensus session, discussions of evidence found during the group interviews led to the final determination of process capability levels. The assessment outcomes were presented to participants. Finally an assessment report with detailed observations and recommendations was provided at a later date after further discussions among the assessment team members.

5.3.2.1 Manual Assessment at CITEC

The manual assessment at CITEC was conducted on 27 November 2013. A list of the individual process attribute ratings for CITEC is included in Table 5.8.

Table 5.8 CITEC Assessment Profile from Manual Assessment

ITSM Process	Process attribute					Capability level rating
	1.1	2.1	2.2	3.1	3.2	
Service level management	F	F	F	L	L	Level 3
Problem management	F	F	F	F	L	Level 3
Change management	F	F	F	L	F	Level 3

As part of the detailed assessment of each of the process areas, seven findings were presented followed by a summary of the overall strengths and perceived risk and opportunities. From the identified risks and opportunities, three proposals for action were compiled by the assessment team. Proposals for action were provided as general recommendations only and it was suggested they be reviewed in the light of the business goals of CITEC. The report was presented to the assessment sponsor (C-AS) on 9 December 2013. The number of detailed findings and action items for each process presented in the report are listed in Table 5.9.

Table 5.9 Number of Findings and Recommendations Provided in the Manual Assessment Report at CITEC

ITSM Process	No. of detailed findings	No. of action items
Service level management	3	1
Problem management	2	1
Configuration management	2	1

5.3.2.2 Manual Assessment at TRC ICT

The manual assessment at TRC ICT was conducted on 15 April 2013. A list of the individual process attribute ratings for TRC ICT is included in Table 5.10.

Table 5.10 TRC ICT Assessment Profile from Manual Assessment

ITSM Process	Process attribute					Capability level rating
	1.1	2.1	2.2	3.1	3.2	
Service level management	L	L	L	P	P	Level 1
Problem management	F	L	L	L	L	Level 2
Service planning	P	P	L	N	N	Level 0
Configuration management	F	F	L	L	L	Level 2
Change management	P	L	L	L	P	Level 0

As part of the detailed assessment of each of the process areas, 31 findings were presented followed by a summary of the overall strengths and perceived risk and opportunities. From the identified risks and opportunities, 19 proposals for action were compiled by the assessment team. Proposals for action were provided as general recommendations only and it was suggested they be reviewed in the light of the business goals of TRC ICT. The report was presented to the assessment sponsor (T-AS) on 9 July 2013. The number of detailed findings and action items for each process presented in the report are listed in Table 5.11.

Table 5.11 Number of Findings and Recommendations Provided From the Manual Assessment Report at TRC ICT

ITSM process	No. of detailed findings	No. of action items
Service level management	8	4
Problem management	8	6
Service planning	6	2
Configuration management	3	3
Change management	6	4

5.3.3 Evaluation of Online Assessment Survey

One of the difficulties to design an online survey is the need to cater for unknown users. Respondents of an online survey may have a range of skill levels in different process roles, and access the system through different contexts of use. The online assessment survey in the SMPA approach was implemented to query the existing process activities regarding how process stakeholders interact with the process. Therefore a transparent measure of usability was considered as the primary factor to evaluate the SMPA approach.

The initial plan was to evaluate usability of the DSS using interviews with all the assessment participants. However, citing workload and time pressures both organisations declined to allow for the extended time required for individual interviews. This difficulty was overcome by conducting a focus group discussion with all the survey participants at each organisation to evaluate the usability of the online assessment survey in the SMPA approach.

A 1.5 hour focus group was organised at each case study organisation in coordination with the assessment facilitator. This researcher and A1 acted as focus group facilitators and introduced topics of evaluation factors into the discussion to gather a range of opinions and ideas from the survey participants. The focus group was conducted with the survey participants soon after the SMPA survey closed. The focus group discussion questions in **Appendix F.3** (p. 267) were introduced in the discussion to evaluate the assessment survey according to the five quality attributes for usability from ISO/IEC 25010 (ISO/IEC 2011a): effectiveness; efficiency; usefulness; trust; and comfort. Since all participants of the focus group discussion had completed the assessment survey, it was interesting to note the inconsistencies and variations that existed among the participants in terms of their experiences and attitudes towards the usability of the DSS. The sessions were recorded and later transcribed for content analysis.

The operational definitions of the five usability characteristics that were used for the evaluation of the online assessment survey are provided in Table 5.12.

Table 5.12 Operational Definitions of Usability Characteristics for Evaluation of Online Assessment Survey

Usability characteristic	Operational definition
Effectiveness	**Accuracy and transparency** of the online assessment survey
Efficiency	**Time, cost and resources** required for the online assessment survey
Usefulness	**Representative and understandable assessment questions** to answer in the online assessment survey
Trust	Confidence in **validity** of the online assessment survey
Comfort	**Ease** of using online assessment survey

Results of the analysis of the focus group discussion at each case are presented next.

5.3.3.1 Evaluation of Online Assessment Survey at CITEC

A focus group discussion to evaluate the usability of the online assessment survey was conducted on 5 November 2013 at the head office of CITEC in Brisbane. This researcher and A1 facilitated the discussion and asked the focus group discussion questions as stated in **Appendix F.3** (p. 267). A summary of the evaluation results of the online assessment survey at CITEC is presented in Table 5.13.

Table 5.13 Evaluation Results of Online Assessment Survey at CITEC

Usability characteristic	Case evidence (No. of key comments from 11 participants)	Selected key comments
Effectiveness	☑ x 19 ☒ x 13 ⊙ x 2	☑ **C-CoM-PM1:** it was more consistent and you were answering a series of questions accurately ☑ **C-SlM-PM1:** if you have individuals doing it separately and anonymously, you may get a better understanding of views from various areas of the business. ☑ **C-CoM-PP1:** if it's you rating responses to questions versus the interviewer writing their interpretation of your answers ... that's where I think online would be more democratic and transparent ... ☒ **C-PrM-PP2:** [Questions] went to a depth that is probably not a depth that we go to. ☒ **C-CoM-PM1:** People understand the first few of them, but they very rapidly go once you get into the higher levels of maturity that you are assessing
Efficiency	☑ x 5 ☒ x 1	☑ **C-CoM-PM1:** … rather than six weeks' worth of engagement, it could be two days' worth of engagement where you could specifically ask ☑ **C-SlM-PM1:** I think if your questions are targeted right, I think online is a faster and accurate approach. ☒ **C-PrM-PP2:** because I could do it online, it didn't have a high priority for me. So a whole bunch of other work got done and I kept putting it off and off. Whereas by coming to a meeting, it's something you have to aim and make sure you're there for.
Usefulness	☒ x 29 ☑ x 11	☒**C-SlM-EPS2:** the questions were too repetitive and asking the same question in many different ways ☒**C-SlM-PM1:** Confusing

		☒**C-CoM-PM1:** I found that you could interpret the question one or more different ways. ☑**C-SlM-EPS2:** I thought the answers were well structured. Sometimes you have the full range of yes, no, don't know, but these had a level of understanding and you could also say 'I don't understand' or 'it's not applicable to my role'.
Trust	☑ x3	☑ **C-PrM-PM1:** I like the idea. I didn't mind the tool... its reliable
Comfort	☑ x 9 ☒ x 2	☑ **C-SlM-PM1:** it was easy enough to use ☑ **C-SlM-PP1:** What I did like when I was going through was the colour… the colour scheme. And I liked the ability to be able to pause and walk away and come back. ☑ **C-CoM-PM1:** You could do it when you wanted and you could stop and start.

☑ indicates the usability characteristic was strongly supported in a comment
⊙ indicates the usability characteristic was not clear or a neutral position was taken
☒ indicates the usability characteristic was strongly opposed in a comment

Accuracy and transparency of the online assessment survey were evaluated to determine its effectiveness. There was a marginally larger number of positive comments (55%) compared to negative comments (38%) for this usability characteristic. Process stakeholders thought that the survey follows a consistent approach that is accurate, transparent and democratic. For example, the process manager of the configuration management process strongly supported the accuracy of the survey and praised the ability to add comments:

> *"I think for accuracy, I think online would probably be more appropriate to be honest, in my opinion. ... You could write a comment. You could qualify your answer, on every question as well, with a comment." (C-CoM-PM1)*

Another process stakeholder raised the problem of preconceived human bias in a manual assessment and how an online survey can overcome such problems:

> *"I think it then depends on the person conducting the interview and their knowledge of you or the organisation. It's all their preconceived ideas built in. Whereas if you are doing it online, it's straight. There's no nagging, no judging … it's transparent in that sense." (C-PrM-PM1)*

However some process stakeholders preferred a manual assessment suggesting that it is more collaborative:

> *"I think one-on-one [manual] is a better option because you have opportunity to seek immediate clarification if you are unsure. And immediate feedback." (C-SlM-PM1)*

Ironically, one of the important criticisms of the online survey was its strict alignment to the ISO/IEC 15504 standard. Several process stakeholders thought that the alignment to the standard is not applicable in a real world setting and work needs to be done to make the questions more relevant. For example:

> *"I felt it was being a bit too clinical in the way questions were drilling down based on the standard. It was making it harder to relate it to real world application." (C-SlM-PM1)*

In terms of efficiency, there was a wide consensus that the online survey requires less time, cost and resources to conduct in comparison with the manual assessment. This is not surprising given the level of automation achieved by the online survey. The majority of comments (over 80%) were positive, such as:

> *"…rather than six weeks' worth of engagement, it could be two days' worth of engagement where you could specifically ask." (C-CoM-PM1)*

> *"I like the idea of online assessment because it's less time consuming and less resource consuming." (C-SlM-PM1)*

There was one particular interesting comment against efficiency of the online survey. One of the process stakeholders suggested that an online survey that can be filled out anytime at your convenience can encourage laggard behaviour:

> *"Because I could do it online, it didn't have a high priority for me. So a whole bunch of other work got done and I kept putting it off and off. Whereas by coming to a meeting, it's something you have to aim and make sure you're there for." (C-PrM-PP2)*

The usefulness of the online survey in terms of representative and understandable questions had largely negative comments (72%). Consistent with the negative comments regarding effectiveness, there were a number of criticisms regarding the applicability of the survey questions due to its strict alignment to the standard. For example:

> *"No, questions did not apply well to the process. I was reading some in the last sections and I was struggling to see how they applied to configuration management." (C-CoM-PP1)*

> *"It took me a few goes to really read them and understand what they were asking. Questions were hard to understand." (C-CoM-PP1)*

> *"About 40% of the questions, I did not have any idea what it was getting at, to be honest. The language was used out of the standard. And that's part of the problem." (C-PrM-PP2)*

One process stakeholder suggested that the survey questions demand background knowledge of the terminology used in the question, particularly from the ITIL framework. Therefore questions would be harder to answer for someone without the knowledge of the terminology, irrespective of their actual process roles:

> *"I think you will get different responses depending on whether someone has done formal ITIL as opposed to just having a fairly good understanding on how the processes work but not understanding some of the terminology." (C-SlM-PP1)*

A universal recommendation to improve the usefulness of the online survey was to provide relevant examples along with the questions. For example:

> *"I found that the examples helped. The examples were more meaningful than the questions, whenever there was an example." (C-PrM-PP1)*

The three direct comments regarding validity of the online survey were all positive. One of the stakeholders suggested that the trustworthiness of the survey promotes transparency in the assessment exercise:

> *"you could see what the tool was trying to achieve. You could see what was being asked, how it was progressing you could see it was getting more complicated because it was asking greater levels of details as you went along." (C-CoM-PM1)*

Finally, more than 80 percent of the comments were positive regarding the ease of using the online survey. Almost all survey respondents complimented the clean interface of the online survey in terms of the colour, layout and format. For example:

> *"colours, layout, sequencing, flexibility in terms of resource requirements it worked quite well on your PCs, there wasn't any problem." (C-SlM-PM1)*

> *"Easy to read and nicely laid out. The development of those pages, there's been a lot of thought gone into that. That was really positive. That generally is what I thought about the tool. I was very impressed with that." (C-SlM-PP1)*

> *"It is a good tool for assessment. … I've done a few technical exams and it's very similar to that kind of thing and it's a very good format to do those kinds of assessments in." (C-PrM-PP2)*

Overall, participants reported that they found the online survey trustworthy, comfortable, effective and efficient. However discussions led to a conclusion that a fully automated online survey that is strictly standards-based is not very useful. It was discussed that human input is critical for the facilitation and support of online assessment surveys in order to clarify survey questions with relevant examples when needed and provide assessment support through expert assessment facilitators, online discussion forums and/ or help screens. It was also noted that all questions do not apply well to the processes and there is a need to provide clearer answer options, better process-role allocation for some questions and more clarity in the display of the assessment goal statements to understand the context of the assessment.

5.3.3.2 Evaluation of Online Assessment Survey at TRC ICT

A focus group discussion to evaluate the usability of the online assessment survey was conducted on 15 November 2013 at TRC. This researcher and A1 facilitated the discussion and asked the focus group discussion questions as stated in **Appendix F.3** (p. 267). A summary of the evaluation results of online assessment survey at TRC ICT is listed in Table 5.14.

In terms of the evaluation of accuracy and transparency of the online assessment survey, there were greater positive comments (70%) in comparison to negative comments (20%), therefore the survey is considered effective. Process stakeholders suggested that the online survey is very objective and that it deters bias from group dynamics in the assessment process and outcome. For example:

> *"I think it's more objective using a software tool compared to an external assessor coming in and listening to what you say and then say 'Mmmmm I think I'll probably give that one a largely or a fully score!' " (T-ChM-PM1)*

> *"And to a degree, the group dynamics, where you don't just have one person dominating the conversation [in manual assessments], whereas the survey tool gives you a say." (T-PrM-EPS2)*

Table 5.14 Evaluation Results of Online Assessment Survey at TRC ICT

Usability characteristic	**Case evidence (no. of key comments from 9 participants)**	**Selected key comments**
Effectiveness	☑ x 14 ☒ x 4 ⊙ x 2	☑**T-PrM-PM1:** You've got the bigger data set – more reliable data. If you have an outliner, you don't skew your results. People may be more honest. ☑**T-PrM-PP2:** That whole subjective nature where it's one person deciding, based on what everybody has said, what the score is ... makes [manual]assessment dependent on the skills of that person. Survey overcomes this challenge. ☑**T-PrM-EPS2:** I think two different versions of the responses based on the group: e.g. managers say something and performers say something else will be very interesting – something that the software can easily do. ☒**T-CoM-PM1:** Some of those examples, I thought, were slightly irrelevant.
Efficiency	☑ x 6	☑**T-PrM-PM1:** the software system has the advantage of giving you a really wide data set. So you can survey 5 or 50 people with no added cost. Also that you don't have to have them in a room.
Usefulness	☒ x 15 ☑ x 3 ⊙ x 1	☒**T-PrM-PM1:** I found some of the questions quite confusing and ambiguous. ☒**T-CoM-PP4:** Some of terminology used in there, depending on the way the question was asked, I think meant different things, to different people. ☒**T-CoM-EPS4:** Answer options didn't seem to be customised to the question; to the result of the question. The seemed to take a generic approach. ☑**T-PrM-EPS2:** the questions are structured well, there are relevant examples and so on
Trust	☑ x 3	☑**T-PrM-PM1:** We could say six months after, let's do that again. The logic seems valid and reliable.
Comfort	☑ x 7 ☒ x 1	☑**T-CoM-PM1:** As far as the page layout, it sort of let you know how you were progressing, the colours, the font and the general interface…was excellent.

☑ indicates the usability characteristic was strongly supported in a comment
⊙ indicates the usability characteristic was not clear or a neutral position was taken
☒ indicates the usability characteristic was strongly opposed in a comment

The ability to easily conduct the survey in-house with a larger number of people was one of the highlights demonstrating effectiveness of the survey approach:

> *"I suppose the beauty of this is that you can do these things in house. You can pick these three processes and see what comes out at level 1. Few weeks later, see what to do to get these to level 2. You've got that control over it. Rather than organising for someone to come in and do it for you." (T-ChM-PM1)*

> *"We have an advantage that we are all in one geographic location. Whereas, other organisations wouldn't have the luxury of getting everyone together, if they were really dispersed. I mean, that's the way you work. The software tool is the only way to do it then." (T-PrM-EPS2)*

However a few disadvantages of the survey approach highlighted the risk of different interpretations of the same question by survey respondents if the questions were not clear. For example:

> *"Survey result is likely to be much skewed because of my interpretation of the questions, as the survey went on, it changed." (T-PrM-PM1)*

In terms of efficiency, there was overwhelming support for the online survey that it takes less time, cost and staff resources to conduct in comparison with the manual assessment. There were no negative comments about the efficiency of the online survey. Process stakeholders suggested that the survey would be a better return on investment and cost effective to operate. For example:

> *"the survey is probably a better return on investment because you are not taking up everyone's time all at once." (T-PrM-EPS2)*

> *"I would imagine it [survey] would be cheaper to do rather than have someone [assessor] across the table for that amount of time." (T-PrM-PM1)*

The usefulness of the online survey in terms of clarity of the questions had largely negative comments (78%). There were many comments regarding repetitive, ambiguous and confusing questions and the terminologies used. Since TRC ICT undertook the assessment up to CL5 and a single process stakeholder often had multiple surveys for different roles, it must have compounded the issue. Interestingly no one complained about the application of the standard to the survey unlike at CITEC. Process stakeholders at TRC ICT thought it was useful that the questions were strictly aligned to the standard but they were fatigued with the number of questions. For example:

> *"There seemed to be a fair bit of repetition in the questions." (T-PrM-PP2)*

> *"I am confused. I am supposed to be looking at this from this viewpoint, now it seems to be the other way around. How do I answer this?" (T-ChM-PP3)*

> *"Lots of questions that seemed to be almost the same as the questions you did. That was where I struggled a little bit." (T-CoM-PM1)*

In comparison with the manual assessment, the usefulness of the online survey was negative because of the lack of support to clarify the survey questions. For example:

> *"With a person on the other side of the table, you could ask a question ... 'do you mean this?'. An assessor would have gone across the ambiguity of the questions. You can get that interpretation that you don't get with online survey." (T-PrM-PM1)*

> *"Plus it's the interaction [in manual assessment]; it's a group of people, so you're all talking about the topic. So, you fairly quickly get it right, or get it corrected." (T-CoM-PM1)*

However a few process stakeholders suggested that the questions are indeed structured since they are aligned to a standard and once you understand the overall structure, the survey was useful. For example:

> *"Once you locked into what was being asked and how it was being presented, then it became a lot easier to answer the questions." (T-CoM-PP4)*

The three comments regarding the trustworthiness of the online survey were all positive. Survey participants suggested that the survey is dependable and can encourage more truthful answers:

> *"They kind of think that they are not being watched. I can answer truthfully here because I'm not going to get in trouble – that kind of thing. It gives you a voice. I mean, you can be anonymous with a survey and not worry that your boss is sitting next to you." (T-PrM-PM1)*

> *"If that's a repeatable process, you are going to get a clear measure as to whether you have improved. With the tool we can depend on it to survey in a consistent manner." (T-CoM-PM1)*

Finally, the vast majority of comments were positive in terms of the ease of use of the online survey. Almost all survey respondents were happy with the interface and the sequencing of the questions. For example:

> *"The interface. I liked that and the presentation. We had just started using SharePoint and it felt very familiar. It felt 'sharepoint-ish'. It was very clean. Some surveys you get, you are hunting – 'what would I do, where I was?' This one was very direct and very well laid-out." (T-PrM-EPS2)*

There was one stand-out negative comment that the convenience of the survey may be ironically a disadvantage since completing the survey is not given priority:

> *"The interface and convenience though about being able to do it easily in your own time, at your own desk, it is a disadvantage because you don't have a set time that you are focussed on this. You've got distractions of people coming up, and then get side tracked on something else." (T-CoM-EPS4)*

In summary, participants reported that they found the online survey easy to use and largely agreed that a self-assessment experience answering direct questions made the exercise more transparent and less costly to implement than a manual assessment. Moreover a tiered approach was recommended, wherein the SMPA approach could be used first to get an overall understanding of process capabilities. Afterwards, to engage in process improvement, human judgment is necessary for assessment validation and improvement based on results. Further clarification of the survey questions with relevant examples, clearer answer options and having more visible goal statements on every question page were suggested.

5.3.4 Evaluation of SMPA Approach Facilitation

The SMPA approach is facilitated by a number of features of the DSS, namely: assessment workflow management; facilitator console; and process measurement. The facilitator console was used to step through the four phases of the SMPA approach. The use of the facilitator console during the first phase, Preparation, has been evaluated as part of the process selection method evaluation in *section 5.3.1*. The second phase, survey, has been evaluated according to the usability of the online survey in *section 5.3.3*. Therefore even though the facilitator console enables the entire SMPA approach, the focus of evaluation of the SMPA approach facilitation is on the third phase, Measurement. Consequently, the facilitator console interface of the DSS is evaluated to determine the usability of the assessment workflow and calculation of process capability scores performed using the facilitator console.

A one hour face-to-face interview was organised with the assessment facilitator at each case study organisation. The two researchers, A1 and this researcher, as interviewers introduced topics of evaluation factors – five quality attributes of software quality in use based on ISO/IEC 25010 – into the discussion and gathered a range of opinions and ideas from the assessment facilitators. **Appendix F.4** (p. 270) presents the interview questions that were used during the evaluation of SMPA approach facilitation. The sessions were recorded and later transcribed for content analysis. The operational definitions of the five usability characteristics that were used to evaluate the facilitator console of the DSS are provided in Table 5.15.

Table 5.15 Operational Definitions of Usability Characteristics for Evaluation of SMPA Approach Facilitation

Usability characteristic	Evaluation focus	Operational definition
Effectiveness	Assessment workflow management	**Accuracy and transparency** of SMPA approach workflow management
Efficiency	Assessment workflow management	**Time, cost and resources** required for SMPA approach workflow management
Usefulness	Facilitator console	**Automation in assessment workflow** by using facilitator console
Trust	Process measurement	Confidence in **validity** of the measurement phase of the SMPA approach
Comfort	Facilitator console	**Ease** of using facilitator console

Results of the analysis of the interviews at each case are presented next.

5.3.4.1 Evaluation of SMPA Approach Facilitation at CITEC

A semi-structured interview to evaluate the usability of the facilitator console of the DSS supporting the SMPA approach was conducted on 5 November 2013 at the head office of CITEC in Brisbane. This researcher and A1 interviewed the assessment facilitator, C-AF, according to the five usability characteristics. A summary of the evaluation results of SMPA approach facilitation is listed in Table 5.16.

Table 5.16 Evaluation Results of SMPA Approach Facilitation at CITEC

Usability characteristic	**Case evidence (C-AF)**	**Selected key comments**
Effectiveness	☒	It's a very limited pilot. So you've got to take what you get…we can't go to business and say – 'right we've had this done and we are going to put everything into it'
Efficiency	☑	It's less disruptive. In that if you were having a manual assessment, you would probably have two rooms booked, people would have to commit… it's not just the cost and time. It's all the planning and booking. [SMPA approach] is better from a resource utilisation point of view.
Usefulness	☑	The approach of asking questions using the online tool and comparing that with a manual assessment... as we have seen, there were good comments by everyone about automation and workflow provided by the tool [SMPA approach]…
Trust	☑	We will promote that [being certified] again. Certainly that stuff goes out as a trustworthy achievement. So if we do this assessment, we can certainly talk about this and say hey, we've done this.
Comfort	☑	I wouldn't have had a problem with that [facilitator console of the DSS].

☑ indicates the usability characteristic was strongly supported by the user
☒ indicates the usability characteristic was strongly opposed by the user

Except for effectiveness regarding the accuracy and transparency of the SMPA approach, C-AF was largely positive about the usability of the SMPA approach in terms of its efficiency, usefulness, trust and comfort. There was an argument that the SMPA approach was ineffective firstly due to limited participation at CITEC and also a lack of confidence on the use of the process assessment standard:

> *"In terms of transparency by following a standard, I don't think most of them would have cared, to say the truth. They are not standards people. It's enough to try and get them to follow a process." (C-AF)*

Upon querying the reason for the lack of interest in the standard, C-AF clarified that the widely used ITSM frameworks and standards such as ITIL or ISO/IEC 20000 would have been interesting but most, if not all, of the assessment participants were unfamiliar with the ISO/IEC 15504 standard:

> *"I think they'd be interested in ITIL or ISO20000 because that is what we are doing. I think they're the standards that they value. I don't know that ISO/IEC 15504 would have the same sort of significance." (C-AF)*

Overall C-AF suggested that the use of a standard for process assessment is better than following a trivial approach, however it is not their area of concern. They would rather focus on their area of ITSM and look for improvements defined in practical terms relevant to the ITSM discipline. Inclusion of an additional standard in the mix is not effective and can bring additional work and confusion:

> *"If you are trying to assess against a standard, you need to sort of work out where you are according to the guidelines of the standard. I mean, we have tried to use COBIT and all that as well. That has different languages. It's always difficult when you try to bring things in. We've had just enough with ITIL." (C-AF)*

In terms of other usability characteristics, C-AF was very supportive of the SMPA approach. The SMPA approach was considered less disruptive and better in terms of resource utilisation. In terms of usefulness, it was suggested that the SMPA approach will encourage more active participation:

> *"If you said to them 'it's going to be online and this is the time period and you can pause and all that stuff', they can fit it in. Rather than saying 'you need to be here'. Because if there's an emergency with a client then they couldn't turn up, and we had a few today that couldn't." (C-AF)*

Moreover, C-AF suggested that the SMPA approach can encourage better process understanding and learning. She thought that the SMPA approach can be useful as a learning tool:

> *"I think probably for residual learning, it [SMPA approach] is useful ... I mean, as process owners you go 'these are the things I'm trying to tell you'. I think maybe it gives an understanding of what we are trying to achieve, and when we say the things we say, we do have an objective in mind." (C-AF)*

C-AF trusted the SMPA approach and the calculation undertaken by the DSS following the standard guidelines. She suggested that it is reassuring to know that the measurement of process capabilities is based on the standard:

> *"I wouldn't really need to go into too much detail on understanding how the scores are calculated. I mean I know there's a lot of work that goes on in the background, but if the tool does it according to the standard guidelines, we are happy. I don't need to have all the statistical information. A brief explanation would be fine." (C-AF)*

There was strong support for ease of use of the SMPA approach using the DSS. Compared with a manual assessment, C-AF suggested that the SMPA approach is an easier approach for assessment facilitators and something they can completely control:

> *"Manual assessment would have been a lot harder. As you saw, and I know you wanted to have everyone in and have individual discussions, it's all about the time that people have to dedicate. These sorts of things are not part of their everyday role. They have things which they consider to be their key roles and this is additional*

> *stuff for them. This way it [SMPA approach] works out a lot easier." (C-AF)*

C-AF also suggested that the automation brought by the SMPA approach should be very comfortable for the target group that belongs to the ITSM industry:

> *"Oh, and they are all tech-heads so they love the automation! I think they would probably prefer to do that (survey and facilitator console) all the time! It's like certification exams for us!" (C-AF)*

5.3.4.2 Evaluation of SMPA Approach Facilitation at TRC ICT

A semi-structured interview to evaluate the usability of the facilitator console of the DSS supporting the SMPA approach was conducted on 15 November 2013 at TRC. A summary of the evaluation results of SMPA approach facilitation is listed in Table 5.17.

Table 5.17 Evaluation Results of SMPA Approach Facilitation at TRC ICT

Usability characteristic	**Case evidence (T-AF)**	**Selected key comments**
Effectiveness	☑	You can set the software up for these processes with these respondents in these roles and send the survey out and you know the data is going to be collected will be relevant to those processes and roles. The software does its job effectively.
Efficiency	☑	There was a smattering of meetings on every day across... there was no way we were going to get all these people into one room. The main plus point with the software assessment is that you don't have to get all the people in the room – and thus saves time.
Usefulness	☑	The software system has the advantage of taking total control of the assessment facilitation – the way it is automated makes it a significant product – definitely useful here.
Trust	☑	As an external facilitator, I can see it [assessment] as being even more difficult. An external person just waves goodbye after the assessment and we never have to see them again. The SMPA approach is more trustworthy in that sense.
Comfort	☑	It's pretty simple. Nominate the processes; populate the roles with different people who perform those functions within the process, click go and the survey goes out. Surveys come back in and the tool gives you a report at the end. It can't be much simpler than that really.

☑ indicates the usability characteristic was strongly supported by the user
☒ indicates the usability characteristic was strongly opposed by the user

T-AF was positive about the usability of the SMPA approach in terms of its effectiveness, efficiency, usefulness, trust and comfort. There were no negative comments about the usability of the SMPA facilitation approach. T-AF thought that the SMPA approach is effective because of the workflow structure it provides:

> *"It provides a lot of structure. The steps to follow are very well defined in the software which makes it an easy task even to me – I have not facilitated any process assessments before." (T-AF)*

In terms of efficiency, the SMPA approach was considered less time consuming due to the fact that it does not require all the process stakeholders to be together at the same time. T-AF complained that it is almost impossible to have everyone together at the same time in their organisation for a manual assessment:

> *"To do the manual assessment, looking at people's diaries, there was just no way were we going to get it done. Even a month out!" (T-AF)*

In terms of usefulness, T-AF suggested that he can be in total control to facilitate the SMPA approach, and hence the DSS is an extremely useful tool. However he cautioned that to make the assessment count, top management support is necessary and lack thereof can make the entire effort useless:

> *"You really need a sponsor with some rank. Someone who really wants to drive it. You need someone to be actively taking interest in it all – otherwise just using the software is just useless to the organisation." (T-AF)*

T-AF suggested that the SMPA approach is more trustworthy than an external assessment since an external assessor is usually not involved in improvements following the assessment. If the DSS does its job according to the standard, T-AF believes that it will be a valid method for repeated assessments. However he recalled an event that hampered the credibility of the SMPA approach. Most of the surveys that each participant received had questions that would be extremely unlikely to be finished in one sitting and could take several hours across several days to complete. Nevertheless a misleading email was sent by a senior manager that said the survey would only take 15 minutes:

> *"The advice was inaccurate. I said that the advice wasn't given by me but everyone knew I was facilitating this. That probably didn't help. You know, the manager is saying one thing, and the software is saying another thing. That may have muffled credibility of the whole thing, but in the end, we got it done." (T-AF)*

Finally, there was a strong support for the ease of use of the SMPA approach using the DSS. T-AF said that the entire approach made sense and was simple to follow.

5.3.5 Evaluation of Assessment Report

Evaluation based on the actual decision quality is time consuming and difficult to measure therefore soft measures such as perceived decision quality factors have been used in DSS research (Jarupathirun & Zahedi 2007). Perceived decision quality and efficiency measure perception after the decision has been made whereas expected decision quality and efficiency can be evaluated prior to making decisions (Parikh, Fazlollahi & Verma 2001). Perceived decision quality and efficiency had been used to explore successful use of a web-based spatial DSS using the TTF fit as an antecedent (Jarupathirun & Zahedi 2007) and subsequently used in other web-based DSS (e.g. Gu & Wang 2009). Since this project did not have sufficient time to evaluate actual decisions based on the assessment report, expected decision quality and expected decision efficiency were used for evaluation of the assessment report.

Three process managers and the ICT director at TRC ICT in the role of the assessment sponsor were interviewed to discuss the SMPA report in comparison with the report from the manual assessment. Likewise only two process managers at CITEC were interviewed since the process manager of the third process at CITEC (C-CoM-PM1) had left the organisation when the evaluation interviews were conducted.

After the SMPA report had been provided to the organisations in December 2013, interviews were conducted with relevant process managers to evaluate their expectations on the usability of the assessment reports. **Appendix F.5** (p. 273) presents the interview questions that were used during the evaluation of the SMPA report. Answers to these interview questions also enabled a comparison of the outcomes of the manual assessment and SMPA approach. Eventually, answers to RQ3 can be determined by evaluating expected decision-making support on process improvements from using the SMPA report by the process managers. The operational definitions of the four usability characteristics that were used to evaluate the assessment report are provided in Table 5.18.

Table 5.18 Operational Definitions of Usability Characteristics for Evaluation of Assessment Report

Usability characteristic	**Operational definition**
Effectiveness	**Expected decision quality** in terms of accuracy and transparency of the SMPA report
Efficiency	**Expected decision efficiency** in terms of time and effort required to use the SMPA report
Usefulness	**Expected utility** of the SMPA report for process improvement
Trust	Confidence in **validity** of the SMPA report

Results of the analysis of the interviews at each case are presented next.

5.3.5.1 Evaluation of Assessment Report at CITEC

A semi-structured interview to evaluate the usability of the assessment report produced by the DSS was conducted on 14 February 2014 at the head office of CITEC in Brisbane. This researcher and A1 interviewed the two process managers at CITEC according to the four usability characteristics listed in Table 5.18. A summary of the evaluation results of the assessment report is listed in Table 5.19.

Table 5.19 Evaluation Results of SMPA Report at CITEC

Usability characteristic	**Case evidence (2 process managers)**	**Selected key comments**
Effectiveness	☒ ☑	☒ **C-PrM-PM1:** we've misunderstood the report … the report wasn't clear ... It did not communicate the capability levels in an understandable format. I am trying to learn to read the report. ☑ **C-SlM-PM1:** well ... there's nothing that really surprises me ... the scores seem accurate
Efficiency	☒ ☒	☒ **C-PrM-PM1:** when I went through it [SMPA report], it seemed to overcomplicate Problem Management [process]... It is really hard and time consuming to read ☒ **C-SlM-PM1:** it [SMPA report] probably would take longer to read … they're too broad and there may be a lot of stuff to read through whereas I suppose the manual report does highlight the gems …
Usefulness	☑ ☑	☑ **C-PrM-PM1:** Yes, I intend to use it [SMPA report]. ☑ **C-SlM-PM1:** Yes… its useful … it has a market in terms of if someone wants to get an idea of improvement
Trust	☑ ☑	☑ **C-PrM-PM1:** I am generally confident with this type of rating … ☑ **C-SlM-PM1:** the online one [SMPA report] is going to be more reliable because you've got a broader audience and the same assessment criteria and formula happening.

☑ indicates the usability characteristic was strongly supported by the process manager
☒ indicates the usability characteristic was strongly opposed by the process manager

Contradictory views were given on the effectiveness of the assessment report in terms of expected decision quality. C-PrM-PM1 thought that the report was incorrect and misleading since it was perhaps too clinical in the way it calculated the process capability scores. The reason behind not achieving a "Fully" (F) at CL1 was suggested as follows:

> *"Look, I don't think anyone is ever going to say 'yes' all the time. You'd have to have everything really nailed down tightly and I think there are always some spots to be improved on ... There must be something that's too stringent as far as providing you a fully score." (C-PrM-PM1)*

Hence C-PrM-PM1 was not convinced of the final score provided by the report. She said:

> *"From a business point of view, I can look at a guide and understand Problem Management. When I looked at this [SMPA report], I got scared thinking ... maybe there's a lot of statistical type information that is sort of ... confusing." (C-PrM-PM1)*

In the other hand, C-SlM-PM1 was satisfied with the report in terms of its effectiveness based on expected decision quality:

> *"it's certainly a good report and probably more transparent because I know the words in the ITIL book and looking at the report I knew what it was trying to say and why." (C-SlM-PM1)*

In response to a query regarding the low score of the Service Level Management process (CL1), C-SlM-PM1 suggested that the score needs to be viewed from a different perspective.

> *"well I look at that and I think, well if I'm 'LARGELY' at [process capability level] one, two, three; as far as I'm concerned, that's good enough ... according to the standard, it's level one but in terms of implementing the processes in the organisation, where do you draw your cost-benefit line? Can I push it to 'FULLY' in anything? Probably not!" (C-SlM-PM1)*

C-SlM-PM1 seemed to be content with scores not being "Fully" (F) because according to his understanding, they are good enough at "Largely" (L). In this sense, C-SlM-PM1 thought that the SMPA report was more accurate and needs to be read pragmatically:

> *"Maybe a better way of saying this is not by saying 'I'm at level one'. The report actually should be read as: 'largely compliant at level one, two and three but deficiencies have started to appear at level four' ... and that makes more sense to me." (C-SlM-PM1)*

In terms of other usability characteristics, there was consistent evidence from both process managers in support of the usefulness and trustworthiness of the report. C-PrM-PM1 intends to use the report regardless of her reservations about its accuracy. Both process managers confirmed the expected utility of the assessment report for process improvement:

> *"But I think these recommendations ... see working through with you, I understand them ... it makes sense and I can use it for improvement." (C-PrM-PM1)*

> *"As an assessment to test your business sustainability and process understanding and compliance, this [SMPA report] is more useful to help make process improvements." (C-SlM-PM1)*

There was also clear agreement in terms of validity of the assessment report from both process managers:

> *"This [SMPA report] is compiled from a testimony of a larger audience and you're using the same algorithm in the software, whereas you're having different assessors in the other report [manual report]. Therefore this [SMPA report] is certainly trustworthy." (C-SlM-PM1)*

> *"Yeah, I am confident with the rating ... you probably need to fix the stringent measurement of FULLY ... and I think a lot of it goes back to the wording ... besides that you can certainly rely on this [SMPA report] ... if you wanted to go into more detail, you would go back*

to this document [SMPA report] because it is more detailed." (C-PrM-PM1)

Finally, expected decision efficiency of the assessment report was not well supported by either of the process managers. Both managers thought that the report was hard to read and understand:

> *"I must admit I found it [manual report] easier to read ... because that's actually quite simple. I know what we did and how we got there. I looked at this [SMPA report] and went OK, there's a lot of stuff that you probably don't need, but there has to be something at the front to explain how to read ... like an executive summary ... which may be a little more user friendly?" (C-PrM-PM1)*

> *"You have finer details [in SMPA report] ... probably would take longer to read and understand ... there is no highlighted list to do that can be easily actioned ... you really need to work through it." (C-SlM-PM1)*

5.3.5.2 Evaluation of Assessment Report at TRC ICT

A semi-structured interview to evaluate the usability of the assessment report produced by the DSS was conducted on 28 January 2014 at TRC. The three process managers at TRC ICT were interviewed according to the four usability characteristics listed in Table 5.18. A summary of the evaluation results of the assessment report at TRC ICT is listed in Table 5.20.

Table 5.20 Evaluation Results of the SMPA Report at TRC ICT

Usability characteristic	Case evidence (3 process managers)	Selected key comments
Effectiveness	☑ ☑ ☑	☑ **T-PrM-PM1:** …whether or not I can make a faster decision, I can certainly ensure that my decision is based on accurate information and hence will be a correct decision with this [SMPA] report… ☑ **T-ChM-PM1:** the answers that have come out of the software process [SMPA report] seem to be a far more accurate assessment of our environment than what the interview assessment [manual assessment report] provided. ☑ **T-CoM-PM1:** your reliability score could give some pointers about having consistent communication. If the reliability is low, we've got some talking to do… such measures make this report [SMPA report] more transparent.
Efficiency	☒ ☒ ☒	☒ **T-PrM-PM1:** …because I must admit, the first time I looked at it [SMPA report], I was overwhelmed. I though wow! this is a lot of detail and it's 35 pages long! How am I going to do this? ☒ **T-ChM-PM1:** It just takes a bit of digging to go through the report [SMPA report] to find all those recommendations and then try to prioritise as well – there's still a bit of lengthy work for that. ☒ **T-CoM-PM1:** Generally speaking though, I'd probably go through this report [SMPA report] and cherry pick a few things that I thought were relevant. It does take a while to read and understand the whole thing.

Usefulness	☑ ☑ ☑	☑ **T-PrM-PM1:** we've already gone through some areas of the report and looked at areas where we need to improve… it gives management something to look on … ☑ **T-ChM-PM1:** we want to act on those actions identified in there [SMPA report] .... Most definitely useful, yeah. ☑ **T-CoM-PM1:** It's useful for showing us the subject areas for where our next steps are …
Trust	☑ ☑ ☑	☑ **T-PrM-PM1:** [SMPA report] is a truer representation of where the organisation is at, with respect to its process maturity. The score reliability information is very handy. You are confident that the score is correct in this [SMPA report]. ☑ **T-ChM-PM1:** score reliability – you've got to read that in context with the rating score. I think that without the reliability, you'd have some question about the rating score … the reliability score certainly makes the findings trusty … ☑ **T-CoM-PM1:** Between me and the two other people I spoke to, I think we did pretty much come to a consensus trusting the results of capability of the processes we got from this [SMPA report].

☑ indicates the usability characteristic was strongly supported by the process manager
☒ indicates the usability characteristic was strongly opposed by the process manager

There was consensus among the three process managers at TRC ICT that the assessment report produced accurate and transparent results and that it was useful and trustworthy. All process managers also agreed that the report is not efficient in its present structure.

In terms of effectiveness, the assessment report was supported to be more accurate and transparent than the manual assessment report. T-PrM-PM1 presented a case of conflicting information in the manual assessment report and suggested it may have been caused by 'group think' during the manual assessment:

> *"... when I was reading both reports – I threw them up on a big screen in a meeting we had last week with [T-CoM-PM1] and [T-ChM-PM1]. I said 'uuuuh there's some conflicting information in that manual assessment report ...' How did that happen? Was there group think during the [assessment] meeting when people start talking ... I don't know ... the SMPA report is certainly more accurate." (T-PrM-PM1)*

Responding to a question to choose between the manual assessment report and the SMPA report, T-ChM-PM1 suggested that he was surprised to find the SMPA report to be more effective:

> *"The software mediated one [SMPA report] aligned closely to our organisation, which surprised me. I was anticipating it would be the other way around – that the interview assessment in the workshop environment would be more accurate, however this one [SMPA report] more accurately reflects what our environment is ... In looking at results of those two reports now, I'd have some concern about the accuracy of the manual process." (T-ChM-PM1)*

T-CoM-PM1 provided testimony that confirmed that the SMPA report was highly effective:

> *"I was more impressed with the results that came with the meditated process [SMPA report] than the manual one. They seemed, from my perspective, to be more consistent with how we actually do things here. It was good that you had the information about the reliability of the data as well – what the spread of answers were for one particular area? So you could have a look of confidence, I guess. Some of the areas, yes we know we don't do it very well, and that was sort of proclaimed." (T-CoM-PM1)*

T-PrM-PM1 endorsed the usefulness of the assessment report by commenting that they have already started to consider the report findings for process improvements. In particular all process managers commended the reliability score which they believed will help to determine the priority areas of improvement:

> *"… score reliability does help you make a decision … I mean if you have a poorer reliability, then you think OK, not going to pay too much attention to that. Although, if the responses are all over the place, you have to ask yourself, why?" (T-PrM-PM1)*

> *"The value of the SMPA approach is proven by its report. I believe this report with recommendations and what it identified in there does give you steps to improve things that are very useful." (T-ChM-PM1)*

> *"How useful? The information back is useful in that it quantified what I knew, my gut feeling anyway. It is good that we actually have some measures now about where we are on the maturity spectrum, I guess, in all these different areas." (T-CoM-PM1)*

All process managers thought that the SMPA report is trustworthy. For example:

> *"I actually think you are going to get more reliable answers in a survey – out of the prying eyes of a supervisor. So I think the results [SMPA report] are more reliable because there is that anonymity and the opportunity." (T-CoM-PM1)*

> *"What I like about the report from the tool is that it is backed up by solid evidence, and the reliability score is fantastic – it helps to determine if we are all thinking in the same direction or all over the place – I feel that the reliability score is more powerful than the process capability score …" (T-ChM-PM1)*

> *"You can take an example of the configuration management process. We know that we don't do that well – in fact you can say the process is not even in place. Surprisingly the manual report said that configuration management is at Level 2 and I have to disagree. The report from the software rightly scored us a Level 0 for this process." (T-PrM-PM1)*

There were negative comments in terms of efficiency of the report mainly based on the structure and length of the report:

> *"It was, I think Change Management, and we had to read it [SMPA report] a few times to get to the bottom and try and work out 'what*

does this actually mean' or 'what's this trying to say'? ... this [SMPA] report is not ready for management at the moment." (T-PrM-PM1)

"Particularly with a report [SMPA report] as large as that, it tends to look for some sort of executive summary or something like that at the front that has key findings or key recommendations. Without that, this report [SMPA report] is arduous to read and use …" (T-ChM-PM1)

In comparison, the manual assessment report was evaluated as easy to read and use:

"I guess the good thing about the manual assessment is they can provide feedback in person. They can say … 'I believe the best way to do it is X, Y and Z'. Whereas if it's in this report [SMPA report], you have to read it and then 'what does that mean?' … it's a bit difficult to get anywhere when there are so many things that are broken …" (T-PrM-PM1)

One of the suggestions provided to improve the efficiency of the SMPA report was to group all process improvement recommendations by rating rather than by capability levels:

"Currently recommendations are grouped at level, yeah. But I think it would be more useful in analysing the report, is group them by rating. That way the areas for improvement, you can pull some key highlight part out and this could be like your executive summary for the report ... It's like prioritising your recommendations, the information is there and it just needs to be presented differently." (T-PrM-PM1)

"If the tool [SMPA approach] could provide some sort of prioritisation that would add value to the report." (T-ChM-PM1)

It was suggested that the report presentation meeting where the structure and logic of the report was explained was crucial to understand how to read the report and such information must be included in the report itself:

"I think how to interpret the report would be very valuable because the first time I read it, I was bamboozled. It wasn't until you sat down in that meeting and said 'this is what you need to do – you need to look at your reliability and your scores and these are the ones you want to look at'. That makes perfect sense I know now." (T-PrM-PM1)

" … the report at the moment, you pretty much have to go through it and know the structure of the report, try and come up with a list of 'here's what I'm going to do as a result of that assessment'. You almost need to pull those details out into a road map to say 'here are the things we're now going to perform as a result of the assessment'. So that would be my one suggestion for improvement." (T-ChM-PM1)

All process managers also confirmed that the recommendations in the SMPA report were valid and more actionable than the manual assessment report:

> *"Since your recommendations are derived from the comprehensive guidelines of ITIL best practices, I think they are detailed enough for effective implementation ... recommendations provided in the manual assessment are very broad and holistic directions." (T-ChM-PM1)*

> *"Numbers speak for themselves. We have over 100 process improvement recommendations derived from the tool [SMPA report] that can be traced back to the identified gap at every question. I think the manual assessment report had less than 20 recommendations that are not very specific." (T-PrM-PM1)*

Along with the process managers, the assessment sponsor at TRC ICT (T-AS), who also participated in the online assessment survey as an external process stakeholder for all three processes, agreed to provide his views regarding the assessment report at TRC ICT and the overall SMPA approach. T-AS suggested that the SMPA approach was convenient but this can sometimes lead to procrastination:

> *"... as convenient as online assessment tools are, they are more prone to being put off." (T-AS)*

T-AS advised that the SMPA approach is effective, efficient and useful, particularly as an instrument for data collection. In terms of efficiency, the SMPA approach was considered to be cost effective:

> *"The logistics of it [SMPA approach] overall, yeah it was great. It was very good." (T-AS)*

Another value of the SMPA approach highlighted by T-AS is its applicability as a training tool:

> *"I suspect that the tool serves as a crew training instrument because knowing that it's based explicitly around the standard, by going through the questions you developed a better understanding of what the standard contains." (T-AS)*

Likewise, T-AS proposed that the SMPA approach can be used to implement process changes in terms of engaging staff:

> *"... the process of being poked and prodded into giving answers and made uncomfortable with the answers you need to give is in itself, it evokes change so with the surveys [SMPA approach] we were motivated to make some changes." (T-AS)*

In terms of the assessment report, T-AS confirmed that the report was useful:

> *"Generally the findings confirmed what we thought to be true, so there was no big nasty surprises in there ... it came up with pretty useful findings." (T-AS)*

In response to the final question to compare the SMPA approach with manual process assessment exercise, T-AS suggested that a blended process of the two approaches might be a better way to conduct process assessments:

> *"… the best result is a combination of the both – the hybrid – this [SMPA approach] is great with data collection, not withstanding what I just said, but then some facilitated workshops to say 'you know you said this, what about that?' and then use that to abstract up some general findings …" (T-AS)*

5.3.6 Technical Evaluation of the DSS Platform

Microsoft Azure (Microsoft 2014) is the underlying DSS technology that provided a platform to conduct the SMPA approach. The research partner AP provided the DSS platform for this research and hence it was a requirement that this platform would be used in this project. ISO/IEC 25010 software product quality model provided a number of key characteristics to evaluate software quality as discussed in Chapter 2, *section 2.10.3*. An *ex-post* evaluation of the DSS platform was conducted based on the software product quality characteristics. Table 5.21 lists how the DSS platform fulfils the requirements of the eight software quality characteristics.

Table 5.21 DSS Platform Technical Evaluation

Software quality factor (ISO/IEC 25010)	**DSS platform technical evaluation**
Functional Suitability	Azure technology delivers a flexible cloud platform that enables reliable hosting with an ability to scale out application code (Microsoft 2014). The DSS platform serves as a robust technology platform for the SMPA approach.
Performance Efficiency	Azure is an automated self-service platform that can be used to provision resources within minutes (Microsoft 2014). This promotes performance efficiency of the DSS platform for the SMPA approach.
Compatibility	Azure platform can use any language, framework, or tool to build applications using open protocols (Microsoft 2014). This ensures compatibility of the DSS platform for flexible development and deployment of the SMPA approach.
Usability	Usability of the software use in terms of effectiveness, efficiency and satisfaction has been evaluated in detail using ISO/IEC 25010 software in use quality model as reported in *sections* 0*, 5.3.3, 5.3.4 and 5.3.5*.
Reliability	Azure delivers a 99.95% availability with automatic service patching, built-in network load balancing and resiliency to hardware failure. (Microsoft 2014). This feature promotes reliability of the DSS platform to facilitate the SMPA approach.
Security	Azure technology uses multi-factor authentication that helps safeguard access to data and applications with a simple sign-in process (Microsoft 2014). The platform is therefore considered secure to use in this research.
Maintainability	With the Azure technology, applications can elastically grow or shrink their resource usage based on their current requirements and application subscribers may only pay for the resources that are used (Microsoft 2014). This feature promotes maintainability and scalability of the DSS platform to support the SMPA approach.
Portability	The Azure client libraries are available for multiple programming languages, and are released under an open source license (Microsoft 2014). This feature promotes portability of the DSS platform to facilitate the SMPA approach.

To summarise, the underlying Microsoft Azure technology of the DSS platform was considered to be suitable for the SMPA approach in terms of the technical evaluation that was based on the software quality model factors from ISO/IEC 25010.

5.4 Design Process Evaluation

The design process evaluation was conducted as an iterative process with multiple cycles of formative evaluations in order to explicate the rigour of the design process. These evaluations attempt to assess if the process of developing the SMPA approach in terms of design process and research method has rigour, practical relevance and aligns well to the international standard for process assessment. Table 5.22 presents the evaluation protocol for the design process, i.e. the method of development of the SMPA approach, which is discussed next.

Table 5.22 Protocol to Rvaluate the SMPA Design Process

Evaluation subject	**Evaluation setting (Time, Type)**	**Evaluation focus (What is evaluated)**	**Evaluation method (How it is evaluated)**	**Evaluation instrument**
Artefact design and development	*Ex-ante*, Artificial	Iterative design process	Evaluation checkpoints in build-evaluate cycles	Design process kernel theory (TTF theory) Design product kernel theories (Balanced Scorecard, SERVQUAL, ISO/IEC 20000, ISO/IEC 15504, GQM, DSS, ITIL)
Artefact relevance in industry	*Ex-post*, Natural	Design principle of automating assessment activities	Interview with P1	Evaluation interview to check artefact relevance in industry
Artefact alignment to the ISO/IEC 15504 standard	*Ex-post*, Natural	Design principle of facilitating assessment workflow	Interview with S1	Evaluation interview to check artefact alignment to the standard
Research methodology	*Ex-post*, Artificial	DSR	Alignment with DSR guidelines	Hevner et al.'s seven guidelines to conduct DSR in IS

5.4.1 Evaluation Checkpoints in Build-evaluate Cycles

Formative evaluations of the SMPA approach (design product) and the design process were conducted as part of iterative design process and have been discussed in Chapter 4. This section briefly states important parts of Chapter 4 highlighting the evaluation checkpoints that occurred during the design and development of the SMPA approach.

The *ex-ante* evaluation took place in several iterations during the design and development of the artefact. As part of an iterative "build-evaluate" cycle (Hevner 2007), several rounds of formative evaluation occurred during artefact design and development. Three checks performed by the multi-disciplinary research team provided evaluation checkpoints during artefact design and development viz. industry relevance check, standards alignment check and academic rigour check. Chapter 4, *section 4.2* discussed the iterative design process in detail. Moreover the application of kernel theories for design process evaluation, particularly the role of TTF theory in the development of the SMPA approach, demonstrates rigour during the formative evaluation cycles.

Several kernel theories were incorporated into the design product evaluation, such as: adherence to the international standard for process assessment ISO/IEC 15504 and the standard for ITSM ISO/IEC 20000; use of the GQM approach to facilitate assessment workflow; and DSS technology to automate ITSM process assessment activities. Moreover, assessment questions were pilot tested with three process managers at USQ's IT department. Feedback received from the pilot test was incorporated to further improve the clarity of the questions as part of the formative evaluation during the artefact development. The iterative design process constitutes cycles of formative evaluations during the design process for the development of the research artefact.

5.4.2 Evaluation of Artefact Relevance in Industry

P1 is the Chief Technology Officer of the research industry partner AP. P1 was involved in the development of the SMPA approach and more specifically provided the DSS platform that supports the SMPA approach. After the development of the SMPA approach, P1 was interviewed in February 2014 at his office in Brisbane, Australia. The interview focused on the evaluation of the artefact design process from P1's perspective as an ITSM expert. More specifically, this evaluation was focused on checking if the research artefact (SMPA approach) met the requirements of the design principle to automate assessment activities.

This research project only considered four ITSM processes. P1 said that while the scope of the processes was limited, this research developed a general framework that is of tremendous value to his company:

> *"We've done only four processes … but we've got the framework in place. The framework is definitely well defined and well structured, so it is feasible to add more processes easily…" (P1)*

P1 suggested that more work needs to be done in the SMPA report from an industry perspective:

> *"The point is that we developed a standards-based report, so from that point of view, it helped us to have a real understanding of the standard. We really like the way it is presented and it does present data really well. From a commercial point however, we'd probably need to add proper 'call to action' in there as well. The idea being that a report like this leads to improvement. Although we list what is 'as is', you need to help the client get to the next level – to build an improvement project off the back of it – that's missing in the current report." (P1)*

P1's opinion about the practicality of the application of the ISO/IEC 15504 standard in the survey questions and calculations was very positive:

> *"I think we've got that right. I really like the way that we 'roll up'. We are collecting lots of answers from different people for the same question. Then of course we are using 15504 across attributes so we are building up the capability of scores." (P1)*

> *"... the 15504 standard fits well with the questions ... For a practical sense however, there are some things that the standard expects that you may well see too detailed because they have got to be at that level of rigour. Whereas, when you look at it in a practical sense, you sometimes ask 'do I need to have a process defined to that level?' But I think we found middle ground. Particularly when I look at results, it's applied quite well and gives us a solid and consistent basis for improvement measures." (P1)*

When asked about his experience on getting involved in this research, P1 suggested that it was an extremely difficult task to translate the standard to make practical sense in ITSM:

> *"The first thing is that you need to understand the standard. Of course once we've established that, writing isn't too bad, except sometimes, you have to use standard's language. Questions went through a few iterations. I used colleagues and they found the same. We all did. We find problematic ones, and then we needed to re-word them. But it was quite hard work." (P1)*

P1 thought that the standard can be applicable in other domains, but CL1, i.e. ensuring that the key process outcomes are met, might be sufficient for many organisations across different industries in practice:

> *"It's a pretty rigorous standard this 15504, so for some processes I can see it being more applicable than others. Take OHS [occupational health and safety], there's a huge amount of rigour, it's going to work fantastic around that. 15504 would be, to use a term, a sledgehammer to crack a nut! In a practical sense, we might be better sticking with the level one questions in some cases and saying 'hey, you've got a process and it's recognised and it's delivering an outcome'. Instead of layering all these things on top of it, like optimisation and KPIs." (P1)*

P1 thinks the research project has huge commercialisation potential in the process assessment industry beyond ITSM and he is keen to identify appropriate industries and markets where there is a potential:

> *"We are already a successful commercial company. In assessments, this project just makes it better and what it also does is take it to other areas where it may have been more difficult. Now we can take a rigorous approach and say 'hey, in this industry we can build a really strong assessment with good robust theories and methodologies behind it'. That's a much more attractive proposition to another industry." (P1)*

In summary, P1 was satisfied with his investment and involvement in this research project. He thought the project delivered outcomes that enhanced his company's assessment platform. His comments regarding the evaluation of the artefact validated industry relevance of this research project. For example:

> *"It certainly met expectations and there were a few value-add rounds along the way to enhancements for software upgrades ... from that point of view alone, it proves that this type of engagement, for a company like us, is a pleasant experience. Looking into the future, we've now directly had validation of what we built is a pretty robust platform and with the inclusion of 15504 as an assessment model ... we can apply everything we have learnt through this project to build more assessments." (P1)*

5.4.3 Evaluation of Artefact Alignment to the ISO/IEC 15504 Standard

S1 is an Adjunct Professor in the Institute for Intelligent and Integrated Systems at Griffith University, Queensland, Australia. He leads the process assessment and improvement group within the Software Quality Institute at the University. S1 is the overall project editor for ISO/IEC 15504 and also a founding member of the international management board for the SPICE project. S1 was remotely interviewed in September 2014 using Skype to evaluate the standards alignment of the artefact development process from S1's perspective as an expert of the ISO/IEC 15504 standard and a certified lead assessor. More specifically, this evaluation was focused on checking if the research artefact (SMPA approach) met the requirements of the design principle to facilitate assessment workflow.

Even though this research only applied the PAM from the ISO/IEC 15504 standard in order to develop assessment survey questions for four ITSM processes, comments from S1 were sought in regards to the SMPA approach and its alignment to the standard's guidelines. S1 suggested that the SMPA approach offers sound support to companies wishing to implement an improvement program beyond ITSM:

> *"At present it is limited to ITSM processes only. If there is a demand, it [SMPA approach] should be extended to software and systems development. If the company was planning a 15504 or 330xx type assessment, it [SMPA approach] could be very helpful in preparation." (S1)*

S1 suggested that questions incorporated in the SMPA approach are well aligned with the standard; however questions in the higher capability levels (CL4 and CL5) need more work for consistency:

> *"I have records covering reviews of the questions incorporated in the tool, and these seem to be quite well aligned. One point that comes out in the results from the tool in the two organisations is that there may be some issues with the CL4 and CL5 questions and analysis. I have a feeling that the results are to some extent slightly inconsistent with the results reported for CL4. This cannot be checked from the manual assessments, as the range for these was to CL3 only." (S1)*

In S1's opinion, the SMPA approach does a reasonable job in comparison with a manual assessment based on testimony alone, such as the RAPID assessment conducted in this research. However for a more rigorous assessment requiring multiple sources of "objective evidence", the SMPA approach only provides limited support:

> *"The key issue in my view is how well the data collected meets the criteria for 'objective evidence', which is required to be the basis for ratings under the standard. In the project, we have used only the RAPID assessment method… RAPID uses only testimony from process performers as evidence, and so is quite close to the tool [SMPA approach] … A manual assessment has the benefit of observing non-verbal communication. Also manual assessment uses expert judgment. The tool [SMPA approach] cannot do these things." (S1)*

When asked about his opinion regarding how he may consider using the SMPA approach in his future assessment activities, S1 suggested that he finds the SMPA approach very useful to support his activities but he will not use it on its own for a complete assessment decision:

> *"If I was to conduct an assessment in an organisation that had been using the SMPA tool, I would see the data generated by the tool as a very useful evidence for the assessment, providing to some extent a 'baseline' that could be validated by reference to additional objective evidence." (S1)*

S1 suggested that the use of the SMPA approach as a stand-alone assessment instrument could be difficult and misleading since it can only support one type of evidence – testimony:

> *"It would make it difficult in managing interactions with the organisation, in that they would have an expectation of results that might not be met when a wider range of evidence was considered." (S1)*

In summary, S1 thought that the SMPA approach is valuable to organisations for self-assessments in order to engage in process improvements. However the SMPA approach cannot be solely used to conduct standards-based assessments. His comments regarding the evaluation of the SMPA approach validated standards alignment of the artefact development process. For example:

> *"In conducting the assessments, I felt that use of the standard process models was valuable in the SMPA tool. I see the main value of the tool being for organisations seeking to implement an assessment-based approach to improvement, rather than as an aid to the performance of assessment." (S1)*

5.4.4 Alignment with DSR Guidelines

The preceding discussions on the development and evaluation of the SMPA approach indicated that it has met requirements of being a rigorous research artefact. Hevner et al.'s (2004) guidelines to evaluate DSR process are used in this research as shown in

Table 5.23 to evaluate alignment of this research to the requirements for a rigorous DSR project.

The guidelines shown in Table 5.23 relate to this research as follows.

Table 5.23 DSR Guidelines, Drawn From Hevner et al. (2004).

Guideline	Description
1. Design as an artefact	Create an innovative IS artefact in the form of a construct, model, method or instantiation.
2. Problem relevance	Provide a solution to an important and relevant business problem.
3. Design evaluation	Use a well-executed evaluation to demonstrate the utility of the design artefacts.
4. Research contributions	Research contributions are clear, verifiable, new and interesting.
5. Research rigour	Construction and evaluation of the design artefact is justified using prior theory and evaluation is conducted with rigorous research methods.
6. Design as a search process	Use an iterative search for an effective solution to the problem.
7. Communication of research	Communicate the results effectively to technology-oriented and management-oriented audiences.

Design as an artefact. This research has resulted in the development of a method to facilitate transparent and efficient process assessments for IT service providers. The SMPA approach is an innovative method as it is the first to provide a goal-oriented and software-mediated assessment of ITSM processes such that the outputs are not only accessible to practitioners, but also more fine-grained and readily corroborated with evidence.

Problem relevance. The SMPA approach is a response to the research opportunities that emerged from the shortcomings of the existing ITSM process assessment methods. It can be argued the ongoing problem of the lack of transparency and costly ITSM process assessments require a “theory for design and action” (Gregor 2006, p. 611) to guide process assessments, not only at the level of process capability determination, but also to provide specific recommendations to improve ITSM processes. The ITSM best practices from the ITIL framework are used to provide process improvement recommendations. Such industry-validated best practices are stored as knowledge items in the knowledge base of the SMPA approach. Therefore, the SMPA approach addresses a relevant problem in the industry.

Design evaluation. Standards and well-documented kernel theories based on extant literature have been used in the development and evaluation of the SMPA approach. An analysis of the PAM from the international standard for process assessment, theoretically-grounded frameworks based on established kernel theories, qualitative case study evidence and comparison with manual assessments in two case study organisations represent evaluation checkpoints to assess the usability of the SMPA approach.

Research contributions. The demonstration and evaluation of the SMPA approach indicated the method can provide a fine-grained analysis of the ITSM processes of an organisation. The method is transparent and efficient due to the use of standard assessment models and DSS technology features. The evaluation of usability of the SMPA approach has also shown a benefit to IT service managers and other process stakeholders in practice.

Research rigour. Following Van Aken (2005), the design of the SMPA approach includes a careful justification of each phase using prior theory and evidence from the case studies. As part of the research project, the design, development and evaluation of the design artefact has used an established research framework, and has been overseen by industry and academic research team members involved in the project.

Design as a search process. The design process was iterative, with IT service managers in the problem domain informing task challenges that were considered to develop and evaluate the SMPA approach as a solution. This study used ongoing comparisons between existing process assessment methods, guidance from extant kernel theories, and case study evidence to develop a useful SMPA approach. Earlier iterations of method development and evaluation fed into further analysis and development of the subsequent phases of the SMPA approach. For example, the development of a structured method to select processes for assessment was applied to obtain a list of three processes for the SMPA approach to be further demonstrated. The three processes determined the scope of the SMPA approach to develop the assessment questions for the selected processes.

Communication of research. The research findings have been disseminated through peer-reviewed academic conferences and journals, industry publications and presentations; and the eventual presentation of this thesis. Intermediate research milestones such as the preliminary models that addressed different research opportunities were presented at several international academic IS outlets. Ten peer-reviewed academic papers regarding this research have been published so far. Research publications include three peer-reviewed academic journals (one accepted but not yet published; one under review) and nine conference proceedings. Moreover, there are three industry publications and presentations regarding the implications of research work in practice. Communication of research ensured that the SMPA approach is accessible to both researchers and practitioners.

5.5 Chapter Summary

The evaluation of the SMPA approach confirmed its potential to address transparency and efficiency challenges in ITSM process assessments. One of the significant achievements of this research is that several components of the DSS based on the SMPA approach have already been commercialised by the research industry partner AP. This achievement provides strong evidence of industry relevance of the research artefact and thereby illustrates an example of effective rigour-relevance balance in DSR (Kuechler & Vaishnavi 2011).

Feedback from the summative evaluation was provided to the industry partner AP for consideration to incorporate further improvements of the assessment questions and the overall SMPA approach. The evaluation of the usability of the SMPA approach can enable further enhancements to the assessment questions, score determination and the assessment reports generated.

Furthermore, with the aid of longitudinal data from repeated use of the SMPA approach, it would be possible to conduct outcome evaluation of the SMPA approach by observing its impact on CSI. Due to temporal constraints, this is beyond the scope of this research project. However these considerations are discussed along with other emerging themes upon reflection on the research work. These discussions are part of the next chapter, Chapter 6 Discussion.

Chapter 6. Discussion

6.1 Chapter Introduction

This chapter summarises and interprets the findings from the artefact design and development detailed in Chapter 4 and the evaluation of the artefact and research method provided in Chapter 5. The aim of this chapter is to discuss the findings in terms of each of the three research questions. This chapter provides context and meaning to the study by raising a number of discussion points for each research question following the research principles of abstraction, originality, justification and benefit (Österle et al. 2011).

The summary and interpretation in this chapter are provided within the context of the study findings from chapters 4 and 5 and prior research findings reviewed in Chapter 2. While chapters 4 and 5 reported the results of the research activities during artefact development and evaluation, this chapter lays emphasis on the interpretation and importance of the findings to articulate key discussion areas that impact research and practice. This chapter brings the research objectives and activities together to discuss the findings of the research questions along with the reflection on research work conducted and the prominent themes emerging from each research question.

Figure 6.1 presents an overview of Chapter 6 illustrating the discussion points for the three research questions.

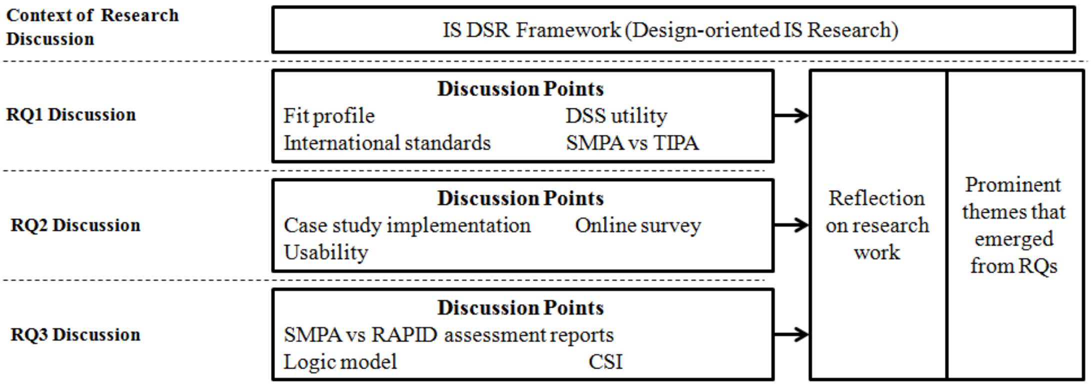

Figure 6.1 Chapter 6 Overview

This section provides an introduction to the discussion of the findings of the SMPA design, development and evaluation efforts. This section is a preamble to the sections that follow and helps link chapters 4 and 5 with this chapter. *Section 6.2* provides the context of the discussion in terms of the research method. *Section 6.3* focuses on findings related to the first research question, *RQ1: How can a software-mediated process assessment (SMPA) approach be developed for transparent and efficient process assessments in IT service management? Section 6.4* is a discussion of the second research question *RQ2: How fit for use is the SMPA approach in IT service organisations?* This is followed by *Section 6.5*, which provides a discussion based on the third research question *RQ3: How fit for use is the outcome of the SMPA approach (assessment report) to support decision-making on process improvements?* The conclusion is provided in *section 6.6*.

6.2 Context of Research Discussion

This research used an iterative design process to develop the SMPA approach and an interpretative case study research to evaluate the usability of the SMPA approach. Discussions emergent from the research methods and outcomes reported in previous chapters provide a context to communicate the impacts that this research can make. The research activities of developing, demonstrating and evaluating the research artefact align with the DSRM phases (Peffers et al. 2008) as explained in Chapter 3. Chapters 1, 2 and 3 provided justification of the research problem, research opportunities and the research method simultaneously. The findings of the three research questions were presented in chapters 4 and 5. This chapter focuses on the discussions about the three research questions. Therefore, the context of research discussion is interwoven with the previous five chapters as presented in Table 6.1.

Table 6.1 Discussion Sections of Thesis Chapters 1 - 5

Thesis chapter	**Chapter focus**	**Discussion context**	**Discussion section**
Chapter 1. Introduction	Introduction of research questions	Justification of the research problem leading to research questions	Chapter 1, *section 1.3*
Chapter 2. Literature Review	Research model	Development of research opportunities	Chapter 2, *section 2.9*
Chapter 3. Research Methodology	Research plan	Justification of planned research activities	Chapter 3, *section 3.5*
Chapter 4. Artefact Design & Development	Activity relating to design and development of artefact	Discussion of findings for RQ1	Chapter 6, *section 6.3*
Chapter 5. Artefact Evaluation	Activity relating to evaluation of artefact	Discussion of findings for RQ2 and RQ3	Chapter 6, *sections 6.4 & 6.5*

In order to provide a context for the discussion, the IS DSR framework developed by Carlsson (2006) is used in this research. Carlsson (2007) pointed out that some of the most challenging problems of IS research are research relevance and practical utilisation. The IS DSR framework provides a useful reference for the discussion of the context in this research due to three major reasons. Firstly, the framework is based on a critical realism stance which is also the underlying philosophy of this research.

Secondly, the framework proposes that the output of DSR activities in IS should provide practical design knowledge based on field-tested and grounded technological rules (Carlsson 2006). According to Bunge (1967), a “technological rule” is a prescription to follow if one wants to achieve a stipulated outcome in a standard setting. A “heuristic” form of technological rule can be designed in a typical qualitative format: “If you want to achieve Y in situation Z, then perform *something like* [emphasis added] action X” (Van Aken 2004). The artefact in this research is akin to a set of heuristic technological rules to develop a novel and practical method for ITSM process assessments.

Finally, the framework suggests that the design knowledge from IS research should be developed through DSR cycles. The methodology outlined in Chapter 3 and the iterative design process of the artefact explained in Chapter 4 confirmed the use of

DSR cycles. Table 6.2 lists the use of the IS DSR framework in this research to provide a context in order to discuss the research findings in the subsequent sections of this chapter.

Table 6.2 IS DSR Framework (Carlsson 2006) Applied in this Research

Characteristic	**IS DSR framework**	**Applied in this research**	**Relevant discussion section**
Dominant Paradigm	Design Science	DSR methodology	Justification of methodology in Chapter 3
Focus	Solution focused	SMPA approach as a solution to address justified research problem	Detailed explanation of solution design and development in Chapter 4
Perspective	Researcher as experimenter (player)	Participatory research and iterative design process	Discussion of RQ1 in this chapter
Logic	Intervention – outcome	Case study to evaluate artefact in terms of usability and outcome	Discussion of RQ2 and RQ3 in this chapter
Typical research questions	Alternative IS interventions for a class of problems	RQ1: Artefact design & development RQ2: Artefact usability evaluation RQ3: Artefact outcome evaluation	Discussion of RQ1, RQ2 and RQ3 in this chapter within the scope of ITSM industry
Typical research product	Tested and grounded technological rules (design knowledge)	Four phases of the SMPA approach	Detailed explanation of the artefact in Chapter 4
Nature of research product	Heuristic	Design knowledge emergent from technological rules	Discussion of RQ1 in this chapter
Justification	Saturated evidence	Case study for usability and outcome evaluation of the artefact	Discussion of RQ2 and RQ3 in this chapter
Type of resulting theory	Practical and abstract IS design theory and knowledge	Design knowledge emergent from technological rules and evaluation of the artefact	Discussion of RQ1, RQ2 and RQ3 in this chapter

For each of the research questions, several discussion points are presented in the form of design knowledge gained as suggested by Gregor and Jones (2007). The *design knowledge* presented in this research includes the description of the *method* to conduct ITSM process assessments, including the *constructs* of assessment goals, questions and metrics defined by the GQM approach (Van Solingen et al. 2002). Pseudo code for the algorithm involved in the DSS implementation of the SMPA approach is also provided (*design principles*). This algorithm is converted to operational software in order to test the method in two case study organisations. The operational software is a DSS for the SMPA approach (*instantiated artefact*).

The design knowledge discussed for the SMPA approach satisfies many of the criteria for partial, nascent theory (Gregor & Hevner 2013). There is a logically consistent set of statements to define the SMPA approach. Constructs and statements are clearly defined with knowledge descriptions at an abstract level. The method, constructs, and algorithm are described in abstract terms without having recourse to the specific software language implementation. This research implicitly contains *technological rules*: for example, “When the process score at every question exhibits high risks, trigger a corresponding knowledge item.” These rules can be converted to an *empirical generalisation* such as “Determination of process capability leads to identification of relevant process improvement knowledge,” a statement that can be empirically tested.

The design knowledge in this research, however, had not yet evolved to the stage where it could be termed “design theory”. There is no explanation of why the method works as it did, or an account of the specific conditions under which it held. It is not yet known exactly what are the adequate assessment questions, process calculations and knowledge items required for a transparent and efficient ITSM process assessment. Further, the design knowledge had undergone only limited testing.

In summary, the context for discussion of the findings from this research is driven by the principles of design-oriented IS research. A memorandum on such a research method proposed by ten authors and supported by 111 full professors from the German-speaking scientific community (Österle et al. 2011) advocates four specific research principles: abstraction; originality; justification; and benefit. In the next three sections, the reported findings of the three research questions are discussed to explicate design knowledge based on the four research principles.

6.3 Discussion of RQ1: Artefact Design and Development

RQ1 is a research question that asked how a solution (SMPA approach) was envisioned and developed to address the research problem (the lack of transparency and need for efficiency in process assessments) and how the solution can be applicable for a class of problems (challenges across the ITSM industry). Chapter 4 provided answers to RQ1. A participatory research approach was undertaken by the research team to combine their shared knowledge and collective experience in the ITSM process assessment domain in order to develop the SMPA approach. This process has been explained and justified supporting the validation of the artefact in Chapter 4.

Specifically, there are two elements in Chapter 4 that explicitly answered RQ1. First, a fit profile was presented as a utility theory (Venable 2006) to establish a concrete set of design principles in order to develop the research artefact (Chapter 4, Table 4.2). Second, the structure of the DSS that facilitated the research artefact (Chapter 4, Figure 4.4) illustrated how the solution was developed and how it is intended to be used. These two findings are discussed in Chapter 4. Based on this premise, four discussion points related to the findings of RQ1 are presented next.

6.3.1 Fit Profile based on the Task-Technology Fit Theory

The fit profile established a connection between the research problem introduced in Chapter 1 and a technology solution based on process structuring and information processing dimensions as proposed in TTF theory by Zigurs and Buckland (1998). This theoretically-grounded fit profile articulated a set of design principles to develop the artefact.

The view of task in this research is at an organisation setting rather than based on individual behaviour. The attributes of a task have been analysed from different lenses previously, such as task complexity (Zigurs & Buckland 1998), task interdependence (Goodhue & Thompson 1995) and time criticality of tasks (Gebauer, Shaw & Gribbins 2010). The task represented in this research is ITSM process assessment. This task has structured activities that are defined in ISO/IEC 15504-2 as normative references. Instead of the task at hand, the existing challenges of the task are represented in the fit profile. The task challenges (the lack of transparency and the need for efficiency) are justified as the research problem in Chapter 2.

From the technology perspective, the three technology dimensions for GSS proposed by Zigurs and Buckland (1998) are communication support, process structuring and information processing. These technology dimensions are used for the development of the SMPA approach. The technology should provide *communication support* to effectively engage key process stakeholders for assessments, viz. process performers, process managers and external process interfaces (Barafort et al. 2009). From the *process structuring* dimension, the technology must facilitate ITSM process assessment workflow – data collection, capability rating and reporting – in a transparent manner. Finally the technology must be able to automate activities of ITSM process assessment for efficiency (*information processing* dimension). The last two dimensions are considered as the “*technology requirements*” proposed for the development of the SMPA approach. The term “technology requirements” was used instead of “technology dimensions” as stated originally in the theory. This is because existing technology dimensions are not evaluated for a fit in this research. Instead a new technology solution that fits task challenges and technology requirements is developed and referred to as the SMPA approach.

TTF theory has been largely associated with evaluative research where a fit of task requirements is sought from existing technologies (Furneaux 2012; Hoehle & Huff 2012). In this research the application of TTF theory is extended to develop 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 to explain development of novel IT artefacts. This also makes sense in the practical world. For instance, in the discipline of IT project management, requirements must be carefully considered before designing and developing a technology solution for any task (Nelson 2007). The integration of TTF theory into the DSR research process is therefore a novel research approach. Fuller and Dennis (2009) suggested that while TTF theory predicts performance during first use of technology well, it does not cater for performance as a result of repetitive tasks over time. The context of technology use in this project is to facilitate process assessments. While improvement projects themselves tend to have repetitive and interactive tasks (Lloyd 2011), conducting process assessments is a relatively discrete and occasional task and hence TTF theory provides a useful lens to study this task.

Zigurs and Buckland's TTF theory was adopted to develop the fit profile for three primary reasons: (a) the DSS, albeit not a GSS technology, shares similar technology dimensions as proposed in the theory, viz. communication support, process structuring and information processing; (b) the approach of designing an ideal fit profile to match task and technology is supported by this theory; and (c) this theory's level of analysis is at a group level which is in line with the application of the SMPA approach in organisations.

With careful analysis of the task challenges and technology requirements, a fit profile was developed to define two sets of design principles for artefact development. Atypical from the perspective of fit as deviation from a fit profile and its effect on performance (Venkatraman 1989), the fit profile in this research is not designed to evaluate existing technology performance. Instead, the fit profile provides two design principles for new artefact development: facilitate assessment workflow; and automate assessment activities. Activities based on the design principles are also mapped to the ISO/IEC 15504 standard reference and thereby they are applied to develop the artefact in order to address the research problem posed in Chapter 1.

6.3.2 Role of the International Standards

Chapter 2 concluded that the existing ITSM process assessment frameworks often use proprietary assessment models and follow indistinct assessment activities. The issue of transparency is therefore a significant hurdle to conduct an objective and standardised process assessment. This challenge can also be viewed from the lens of Agency Theory (Eisenhardt 1989a) as information asymmetry looms due to the lack of transparency. International standards harmonise technical specifications of products and services to break barriers to international trade by offering transparent benchmarks (Marquardt & Juran 1999). Even though standards provide authoritative statements of good professional practice, such statements are general principles rather than precise details of activities to be undertaken (Bevan 2001). Due to this role of the international standards, they promote transparency in the way activities are undertaken. The artefact in this research, the SMPA approach, provides prescriptive details of activities to be undertaken for ITSM process assessment. However the artefact is scaffolded by the principles of international standards in order to support and validate the prescribed activities. Linking back to Agency theory, the international standards play a crucial role to reduce information asymmetry in the agency relationship of business and IT service provider during assessments.

In this light, the SMPA approach follows the international standards of ITSM and process assessment to transparently conduct ITSM process assessments. Likewise, the SMPA approach is evaluated using the international standard for software quality in use model. The use of the international standards in the design and evaluation of the artefact promotes quality improvement, cost savings and increase in productivity and competitive advantage (ISO 2014) in the way the artefact is developed and used in this research.

Standards have been credited with facilitating communication in IS and making the discipline more consistent and predictable (Getronics 2006). The true value of a standard evolves by facilitating data exchange and consequently reducing the cost of information. Quality and cost efficiency are two major objectives in almost all best practice standards (ISO 2001). Therefore standards should belong to the public domain and be universally applicable in order to be used in a transparent manner (Kumbakara 2008). Clause 4.2.1 of the ISO/IEC 15504 standard (ISO/IEC 2004b) mandates the requirement of a documented assessment process that helps to determine the workflow for ITSM process assessments. Following this standard, the SMPA approach provides a structured method to conduct process assessment in ITSM.

The application of the international standards in the development of the SMPA approach is one of the key facilitators to create a fit between the technology requirement of process restructuring and the task challenge of the lack of transparency. The SMPA approach must define the assessment process workflow by which the entire procedure is conducted, including the initial planning and scoping of the assessment as explicitly documented in clause 4.2.1 of ISO/IEC 15504-2 (ISO/IEC 2004b). Similar steps are defined in the TIPA framework with a structured set of activities: definition; preparation; assessment; analysis; results presentation; and closure phases (Barafort et al. 2009). In this research, the technology requirements of process structuring have led to the development of the SMPA approach that can facilitate the entire assessment process in a transparent manner. In this way, the international standards have enabled the design and evaluation of the SMPA approach.

6.3.3 Utility of Decision Support System (DSS)

The steps of assessment data collection and validation, rating of the process attributes and reporting of the assessment results as listed in 4.2.2 of ISO/IEC 15504 (ISO/IEC 2004b) require gathering, aggregating, evaluating and finally presenting information regarding ITSM process assessment. Therefore, having a sound information processing capability is an important requirement for efficient implementation of the SMPA approach. In this scenario, the DSS for the SMPA approach can be a cost effective solution. The data sets from large numbers of process stakeholder responses represent several iterations of targeted assessment questions. A DSS can be used to automatically store and analyse assessment data. In this way data analysis can be low cost and happens in real time for each assessment. Moreover DSS can extend the bounds of rationality for decision makers through their capabilities (Todd & Benbasat 1999).

The automatic storage of collected information provides an opportunity for validated data to be used to compare process assessment results for benchmarking and demonstration of process improvement. This is important as currently no aggregated analysis could be carried out with the existing manual process assessment methods. The literature review in Chapter 2 demonstrated that while there are software tools available for assessors to input assessment data, no software tools have been reported that can capture information directly from the stakeholders and analyse them using the international standard for process assessment. This feature is implemented in the DSS employed by the SMPA approach.

Anecdotal evidence suggests that manually entering data and subjective judgment based on interviews and document reviews can be error-prone and requires a longer time commitment from the assessment team. Consequently the entire process assessment method becomes costly. This means that repeated process assessments to build a repository of process improvement recommendations are unlikely to be given a priority due to the significant workload involved in the process assessment effort. The utility of the DSS in the SMPA approach promotes efficient information processing of assessment data, thereby reducing the entire assessment cycle that can subsequently lead to swift process and service improvement in ITSM.

For the process selection activity in Phase 1 of the SMPA approach, a service gap perception perspective was chosen because it gives responses from the key stakeholders about which ITSM processes need improvement. Likewise, business drivers were reviewed since they enable analysis of the relative importance and impact of ITSM processes to the business goals.

In Phase 2 (Survey) of the SMPA approach, the responses from the process assessment exercise are grouped in different process roles, thereby making it possible to analyse scenarios such as when process managers provide a skewed opinion of the process being performed in contrast with the process performers. Such readings can help IT service managers to perform gap analysis and understand deficiencies in the process activities. These types of analysis would not be easy to realise from interviews. As well, the DSS can be useful to validate the collected data.

Likewise, in Phase 3 of the SMPA approach, the logic of process capability determination and calculation of the reliability score of the survey responses is a feature of the DSS that is not explicitly stated in the ISO/IEC 15504 standard. This is an example that the DSS can expand its functionality and use several data analysis techniques to develop an objective measure of process capability without the need of lengthy subjective discussions among the assessment team members. Moreover with the help of the DSS, a process profile is developed that includes the process attributes and their ratings along with the rationale for the ratings (ISO/IEC 2011c). The DSS can process these calculations relatively more efficiently than humans.

For Phase 4 of the SMPA approach, the DSS uses a knowledge base compiled from the ITIL library for process improvement recommendations. Without a DSS, compilation of an assessment report with process improvement recommendations would require an assessment team with multi-disciplinary skills and expertise in process assessment and ITSM, working for a considerable period of time to compile relevant recommendations. The knowledge-based DSS can efficiently draw on expert knowledge of process improvements from its knowledge base.

Ultimately, the utility of the DSS is to enable organisations to self-assess their ITSM processes in order to understand process gaps that can be resolved before a formal assessment is conducted if required, consequently driving efficient continual improvements in ITSM processes and services.

The utility of the DSS can be linked back to Transaction Cost Economics theory (Williamson 1981). Based on the theory's proposition, the DSS in the SMPA approach can reduce transaction costs by conducting assessments internally with minimal resource requirements since software can automate several process assessment activities. Clause 4.2.2 in ISO/IEC 15504-2 lists key process assessment activities. A number of activities can be automated with the use of a DSS. Automating the entire process assessment activities may not be feasible for a formal assessment due to the subjective nature of process metrics. However this research is based on the premise that a “low rigour” process assessment exercise that aligns with ISO/IEC 15504 but consumes less resources and time can be automated. Consequently the SMPA approach is proposed in this research. The SMPA approach can enable organisations to develop a sense of direction about their process improvements. At the same time the artefact can assist formal process assessments by providing a source of evidence to decide the process capability ratings and provide improvement recommendations. This opportunity can address the efficiency challenges for ITSM process assessment.

6.3.4 SMPA Approach vs TIPA for ITIL

Several ITSM process assessment methods proposed in academic research work and from ITSM industry initiatives are detailed in Chapter 2. There is a lack of discussion about process assessment methods in the ITSM community. TIPA is the most relevant and widely used ITSM process assessment framework that is explained in adequate detail. Moreover, TIPA is based on academic research and is currently being promoted for industry adoption. Mesquida et al. (2012) executed a systematic literature review on ITSM process assessment based on ISO/IEC 15504 and found the highest number of studies related to the use of ITIL and ISO/IEC 15504, which is the foundation for TIPA. Therefore, TIPA for ITIL can be considered as the most rigorous and relevant ITSM process assessment method available in the present day. In light of this position of TIPA for ITIL, it is an interesting discussion point to compare and contrast the SMPA approach with TIPA for ITIL.

The proposed SMPA approach in this research is closely related to the TIPA framework since both methods are open frameworks that uses a consistent PAM based on the standard ISO/IEC 15504. TIPA uses ITIL as the PRM for assessment and certification. The SMPA approach, on the other hand, uses ISO/IEC 20000-4 as the PRM and ISO/IEC 15504-8 as the PAM for ITSM process assessment. The SMPA approach does not advocate any certification but is driven towards self-assessment and progressive improvement activities. Moreover, TIPA focuses on interviews as the main means for collecting evidence to determine process capability whereas the SMPA approach incorporates online surveys for assessment data collection. The SMPA approach uses a DSS to calculate process capability scores. In the TIPA for ITIL method, determination of process capability scores is undertaken through expert judgment from the assessment team after carefully reviewing all evidence. In the same way, TIPA for ITIL uses the domain expertise of the assessment team and a number of reporting templates to compile the assessment report with process improvement recommendations. In contrast, the SMPA approach generates process improvement recommendations from a knowledge base derived from the ITIL library.

While the methodology of the two methods aligns very well, the DSS facilitates several activities in the SMPA approach for efficient ITSM process assessment. However there is only one type of evidence (survey responses) collected for assessment in the SMPA approach. Hence, unlike TIPA for ITIL, the SMPA approach may not be useful as a sufficient method for formal process assessments. Consequently, the SMPA approach has been targeted for self-assessments aimed at quick results to loosely indicate process capability levels in order to drive process improvements. However, evaluation findings in Chapter 5 revealed that the perspective of relevant process improvement recommendations is valued more in the ITSM industry rather than the focus on the precision to determine process capability scores. This finding reassures the position of the SMPA approach as a self-assessment method in practice.

6.3.5 Reflection on Research Work Concerning RQ1

In this section, a critical reflection on research activities is provided to develop heuristic design knowledge from the DSR method experience. A critical reflection can create unique connections between disparate sets of research knowledge and consequently new perspectives about this research can be developed (Jasper 2005).

Discussion of RQ1 presented the idea that a technology solution fits well to address the challenges of ITSM process assessment. The position of this researcher, as a PhD student and an experienced software architect, made the experience to develop the SMPA approach a rewarding journey wherein this researcher employed both theoretical insights and practical IT skills. The two aspects of DSR activity, academic rigour and industry relevance (Straub & Ang 2011), enabled this researcher to reflect on the core issue of RQ1 – how a proposed technology (DSS functionality) may solve a justified research problem in ITSM process assessment activities.

Firstly, the most prominent experience while developing the artefact was the advantage of working in a multi-disciplinary team comprising academic staff, industry practitioners and experts on the international standards. This researcher learnt that good teamwork is the key to success in DSR activities when time and resources are limited. An excellent working relationship with an industry partner (P1), key insights from an international standards expert (S1) and ongoing support from academic supervisors ensured that the research artefact was developed to meet the research objectives.

Secondly the TTF theory (Zigurs & Buckland 1998) provided theoretical support and practical guidelines to develop the design principles for the SMPA approach. The concept of fit to solve challenges in ITSM process assessment using a technology solution has been applied throughout the design, development and *ex-ante* evaluation cycles using the DSR methodology.

There were two significant challenges faced during the research work related to RQ1. First, the process models of the international standard for ITSM and process assessment were in a period of transition during the artefact development in this research. Therefore inconsistency was apparent in the way the process models were structured. The PRM for ITSM (ISO/IEC 2010) was published as a technical report in 2010. This model was based on ITSM processes listed in the ISO/IEC 20000-1 standard published in December 2005. However ISO/IEC 20000-1:2005 was replaced with ISO/IEC 20000-1:2011 in June 2011 along with an updated set of requirements to maintain a service management system. A corresponding PRM based on the updated standard has not yet been published.

When this research commenced, the PAM for ITSM (ISO/IEC 2012b) was not published as the final technical standard document. This researcher started working with a draft PAM document before it was officially released in late 2012. Fortunately there were no significant changes between the two versions. Finally the measurement framework for process assessment is based on the international standard ISO/IEC 15504-2 (ISO/IEC 2004b). A new framework with updated metrics and assessment concepts is expected to be released in a set of upcoming process assessment standards from the ISO/IEC 330xx family (Rout 2014). In this research, the latest available versions of the standards and their process models were used. However some were inconsistent and outdated due to the changes in the standard that occurred during this research and/ or is expected to occur in the near future. When a new set of stable process models and standard guidelines is published, it is likely that the research artefact will need to be updated with changes to questions, calculations of process capability scores and recommendations for process improvement. However this researcher believes that the overall SMPA approach is a valid and useful method.

Second, while developing the research artefact, this researcher focused on the four ITSM processes selected for assessment by the two case study organisations. Survey questions were developed and tested for the four processes. Subsequent testing of process capability calculations and generation of process improvement recommendations were also focused on the four selected processes. Upon reflection, it is realised that the focus on the ITSM processes constricted the scope of the artefact and the vision of this research. It may have been better if the focus was on the generic practices that were the same for every process to determine higher process capability levels (CL2 and above) as specified in the PAM of the ISO/IEC 15504 standard (ISO/IEC 2012b). Rather than attempting to create questions for each of the four processes, it would perhaps have been worthwhile to work more on the generic questions that apply to all the processes and then examine connections with the individual processes by providing specific examples along with the questions. If this researcher had approached the development of the SMPA approach in this way, perhaps there would be fewer complaints about irrelevance and difficulty of the higher capability level questions as reported during the evaluation of the artefact.

6.3.6 Prominent Theme Emerging from RQ1

The existing guidelines for ITSM process assessment are costly and lack transparency. In this research, the SMPA approach was aligned with the international standards of ITSM and process assessment and implemented with a DSS to overcome this problem. A collaborative effort between academic researchers and industry practitioners has facilitated the artefact development. The requirements for a transparent ITSM process assessment and the technology features to address such requirements have been considered to develop the artefact with the help of a theoretically-grounded fit profile.

The reporting of the research journey of problem identification, objectives of the solution and finally the introduction of a solution with justification of every stage of design and development was discussed in the previous sections and Chapter 4. Chapter 4 is focused on the research artefact (RQ1) and consequently it is the largest chapter in this thesis since DSR advocates that the central focus of research should be the artefact itself (Hevner et al. 2004).

The most prominent theme that emerged while discussing RQ1 is the positive impact of technology to facilitate and automate ITSM process assessments. Discussions on RQ1 suggested that there is a strong fit of the utility of a DSS technology to support ITSM process assessments. Therefore, the activities related to ITSM process assessments can be "virtualised", i.e. absence of physical interaction between people, for instance in the context of virtual teams (Fiol & O'Connor 2005). Manual activities during planning, data collection, analysis and presentation of results in ITSM process assessments can be virtualised using the research artefact discussed in RQ1.

The impact of the SMPA approach in ITSM process assessments can be observed from the lens of Process Virtualization Theory (PVT) developed by Overby (2008). PVT is designed to explain whether any process is suitable to be followed virtually or not, i.e. the virtualisability of a process. Process virtualisation is a recent IS trend as seen in virtualisation of friendship using social networking sites, virtualisation of shopping via e-commerce or virtualisation of education using online learning platforms (Bose & Luo 2011). According to the PVT, there are four requirements that have a negative relationship to process virtualisability. The requirements are: (a) sensory requirements – process stakeholders enjoy sensory experience of the process; (b) relationship requirements – process stakeholders interact with each other; (c) synchronism requirements – efficient operation of process activities; and (d) identification and control requirements – process activities require unique identification of process stakeholders and control of its actions (Overby 2008). However the theory posits three IT-enabled moderating constructs that affect the four requirements to positively impact process virtualisability. The three moderating factors are: (a) representation – IT can help to present relevant process information; (b) reach – IT can help to engage more process stakeholders in less time and effort; and (c) monitoring capability – IT can verify process stakeholders and track their process activities. Since the SMPA approach is an IT driven method for ITSM process assessments, the research artefact is well positioned to make the ITSM process assessment more virtualised.

In terms of representation, the SMPA approach presents process information according to the process models from the international standards for ITSM and process assessment, and using the knowledge base from the ITIL library. With an online survey interface, the SMPA approach can query and capture responses from all the process participants regardless of geography. Therefore there is a wider "reach" possible from using the SMPA approach. Likewise, assessment responses can be verified and analysed using the DSS and knowledge base capabilities (monitoring capability). Therefore from the discussions of RQ1, it emerged that the three aforementioned moderating factors have positively influenced virtualisability of the process to conduct ITSM process assessments.

Virtualisability of ITSM process assessment is the major theme emerging from the discussions of RQ1. Moreover, discussion with the industry partner P1 and the international standard expert S1 regarding the development of the SMPA approach suggested that the SMPA approach can be expanded to capture different objective evidence for assessment in addition to the testimony from online surveys. If the DSS functionality allows recording of assessor notes from assessment interviews and provides a standards-based checklist of process-related records and documents, there is an opportunity for the SMPA approach to collect several types of assessment evidence for automatic and manual analysis and reporting. This can potentially lead to the development of the SMPA approach as a fully compliant ISO/IEC 15504 assessment facilitation tool with several types of virtualised activities for ITSM process assessments.

6.4 Discussion of RQ2: Artefact Usability Evaluation

Evaluation of the fit to use the SMPA approach in IT service organisations is the enquiry of the second research question RQ2. Chapter 5 provided answers to RQ2 through the evaluation of each of the four phases of the SMPA approach and phase 2 online assessment survey in particular. In phase 1 (process selection method) of the SMPA approach, only a limited number of process managers from a single case study organisation (TRC ICT) were involved. For phase 3 measurement, interaction with process stakeholders was limited to the two assessment facilitators from the two case study organisations and most of the processing is done by the DSS. Likewise, for phase 4 improvement, evaluation relates to RQ3 – the outcome of the artefact. Discussion of RQ3 is presented in *section 6.5*. This means that the evaluation findings of phase 2 online assessment survey of the SMPA approach are primarily used to answer RQ2 since most of the case study participants – process managers, process performers and external process stakeholders – were involved in this phase only.

Table 6.3 lists a summarised view of the evaluation findings from all the case study participants to answer RQ2. For phases 1 and 3 of the SMPA approach, there is overwhelming support for the SMPA approach. Evidence-based decision-making support provided in the process selection method (phase 1) and the level of automation to measure process capability scores (phase 3) were fully endorsed by most of the participants.

Table 6.3 Consolidated Evaluation Findings for RQ2

Usability factor	**Online survey (phase 2)**	**Process selection method (phase 1)**	**Facilitator console (phase 3)**
Effectiveness	☑	☑	⦿
Efficiency	☑	☑	☑
Usefulness	☒	☑	☑
Trust	☑	☑	☑
Comfort	☑	N/A	☑

☑ indicates the usability factor was strongly supported by the majority of participants
⦿ indicates the usability factor was not clear or a neutral position was taken by the majority of participants
☒ indicates the usability factor was strongly opposed by the majority of participants

According to the five usability factors used during the evaluation, there were predominantly positive remarks about the effectiveness, efficiency, trustworthiness and comfort relating to the online assessment survey (phase 2) of the SMPA approach. However most of the participants found that the online survey was not useful for ITSM process assessment. The major concern was that the participants felt the assessment questions were not representative of what they do and very hard to understand. These findings are presented in Chapter 5. Based on this premise, three discussion points related to the findings of RQ2 are presented next.

6.4.1 Case Study Implementation: A Technology Diffusion View

Implementation of the SMPA approach at the two case study organisations was challenging since using this approach meant engaging with process stakeholders to assess their work. Even though the focus was on the assessment of processes, this can easily be perceived as performance evaluation of individuals' work. This is why it may be difficult to convince an internal organisation to participate willingly in a process assessment since it may be seen as an intrusion into the organisation (Hilbert & Renault 2007).

Engaging key stakeholders is a critical success factor for any technology intervention project (Nelson 2007). The introduction of the SMPA approach is no exception. Therefore engagement with process stakeholders is crucial for the success of ITSM process assessment. The SMPA approach has been designed with this consideration and adopts a number of features that support stakeholder engagement in all phases of the SMPA approach as listed below:

- Phase 1: Input organisation unit profile
- Phase 1: Define assessment scope
- Phase 1: Specify assessment constraints
- Phase 2: Allocate appropriate roles to process stakeholders for assessment
- Phase 2: Complete online survey by process stakeholders
- Phase 3: Engage assessment facilitators to use the facilitator console
- Phase 4: Report assessment results with improvement recommendations.

In the context of ITSM, the SMPA approach is an innovation that has not been previously used by organisations. Hence, this research can view the innovation diffusion perspectives from the organisational innovation literature to discuss the case studies' implementation of the SMPA approach. Cua and Garrett (2009, p. 243) commented that "the innovation could be strategic to a vision or reactive to a crisis." Since the SMPA approach is presented as an organisational innovation for improvement, it falls under a strategic innovation. An innovation diffusion framework can be used to identify factors that impact its implementation.

Diffusion of Innovations (DOI) theory originated from the sociology discipline. This theory explains the process of diffusion where "an innovation is communicated through certain channels over time among the members of a social system" (Rogers 1995, p. 10). This theory is widely used in the IS discipline to find epistemological paradigms of the "IT implementation" construct (Mahmud et al. 2009). According to DOI theory, there are five stages of implementation of technology diffusion: (a) knowledge – understanding of the technology; (b) persuasion – recognising the utility of the technology; (c) decision – commitment to implement the technology; (d) implementation – using the technology; and (e) confirmation – supporting the technology for subsequent use due to positive outcomes. DOI theory in this research can apply the SMPA approach as the innovation and the stages of technological innovation during case study implementation as a form of diffusion of the innovation.

The SMPA approach was introduced to the case study organisations highlighting the features of the research artefact to conduct ITSM process assessment. This corresponds to the "knowledge" stage of technology diffusion. The case study organisations were determined to improve their ITSM processes using a transparent and cost-effective assessment approach. Hence they recognised the utility of the research artefact (persuasion stage) and commitment was obtained from both case study organisations to implement the SMPA approach (decision stage) from the beginning of this research project as reported in Chapter 1. These precursors were critical stages of technology diffusion for effective adoption. Even though there were a number of organisational challenges faced during the evaluation of the research artefact, as reported in Chapter 5, both case study organisations supported the implementation of the SMPA approach (implementation stage). The final stage of technology diffusion (confirmation stage) is beyond the scope of this research since evaluation of subsequent use of the SMPA approach could not be conducted due to time constraints. However discussion of RQ3 in the next section (*section 6.5*) will shed some light on the positive outcomes of the SMPA approach.

There are several theories that explain acceptance and use of technology such as the Technology Acceptance Model (Davis 1985), Theory of Planned Behaviour (Ajzen 1991) and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003). However, these theories are predominantly applied at an individual level of analysis while DOI theory can be applied at an organisational level which is relevant to this research. Moreover, the SMPA approach as an innovation requires ongoing engagement with practice. Hence, the five stages of technology diffusion explained by DOI theory appear logical. It is also suggested that case study research is particularly applicable for innovation and diffusion concepts (Cua & Garrett 2009). In this regard, DOI theory also supports the methodology choices of case study research used in this research.

Orlikowski (2008) suggested that according to the structurational model, technology, organisation (structure), and individual (agent) are the three pillars of effective IS structure. Hence, besides the technology itself, the implementation of any innovative approach, such as the SMPA approach, depends on the organisational and individual factors, such as top management support, resource constraints, and the preferences and perceptions of IT service managers and employees. These factors are not considered for analysis and reporting during the evaluation of the SMPA approach since they are highly contextual in nature. While these factors are important for deeper understanding to emerge, the DOI theory focuses on the technical features of an innovation (Bose & Luo 2011). Consequently the focus of RQ2 is on the technology factors, i.e. the usability of the SMPA approach after case study implementation.

6.4.2 Usability as the Evaluation Criteria

As suggested by the PVT theory, process virtualisability, i.e. how the assessment process is conducted using the SMPA approach, can be measured either as adoption of the virtual process or the quality of the outcomes of the virtual process (Overby 2008). Discussion of RQ2 focuses on the first measure, i.e. evaluation of the usability of the SMPA artefact at the two case study organisations.

A common criticism of ITSM process assessment is that the guidelines are not prescriptive enough for effective implementation in industry (England 2012). Therefore, process assessment guidelines need to provide specific steps to follow in order to assess processes. To implement the SMPA approach as a valid solution for ITSM process assessments, it was essential to verify that the SMPA approach was usable. Therefore, usability factors are presented as the evaluation criteria to gather data required to answer RQ2 in this research.

TTF theory suggests performance improvement as an indicator of a fit between task and technology (Zigurs & Buckland 1998). The fit profile was discussed for RQ1 in *section 6.3*. Evaluation of the performance of the fit profile in terms of artefact usability (RQ2) is discussed in this section. The utility of the SMPA approach in terms of the usability of the underlying DSS that supports the SMPA approach were evaluated at both case study organisations. The concept of usability as defined in ISO/IEC 25010 software quality in use model (ISO/IEC 2011a) was applied for artefact evaluation. The definitions of the five software quality characteristics stated in the standard were transformed to operational definitions of usability characteristics for each phase of the SMPA approach in order to evaluate the SMPA approach in specific contexts of use. These factors were used as a basis for focus group discussions regarding the usability of the SMPA approach at the two case organisations.

Finally in terms of the application of usability as the evaluation criteria, it can be argued that the SMPA approach only becomes more usable in subsequent rounds after it is first implemented, resulting in more efficient assessments for ongoing process improvement projects. For example, repeated use of the DSS to select ITSM processes (phase 1) may not be required in the same degree of detail for future process selection decisions. Likewise, online surveys may be conducted progressively at different process capability levels along with gradual reviews of the process improvement recommendations in the assessment report. Each subsequent iteration of the SMPA approach in an organisation can reinforce the final stage of the innovation diffusion process (confirmation stage), thereby making the artefact more usable at every iteration during the CSI lifecycle. This method is likely to resolve the issue of the lack of usefulness reported during the evaluation of the online survey. A phased and repetitive approach to conduct assessment surveys may ensure that the level of understanding of assessment questions can improve. Furthermore, assessment questions can be easily edited for clarity by adding relevant examples and providing representative references, thereby enhancing the usability of the SMPA approach in each assessment cycle.

6.4.3 Use of Online Survey in Process Assessments

Surveys are best suited for "studies that have individual people as the unit of analysis" (Bhattacherjee 2012, p. 73). In this research, the online assessment survey belongs to a "group" unit of analysis for different process roles in an IT organisation. The limitation of using a survey with the group as the unit of analysis is that "such surveys may be subject to respondent bias if the informant chosen does not have adequate knowledge or has a biased opinion about the phenomenon of interest" (Bhattacherjee 2012, p. 73). It is probable that the process stakeholders may have a biased opinion on their processes specific to their roles. However provided the survey respondents have an introductory understanding of ITIL, such as the ITIL foundation certificate (TSO 2011), ITSM terminologies and their application are consistent. Both case study organisations, CITEC and TRC ICT confirmed that they actively promote the ITIL framework and their staff have attended ITIL trainings. In this environment, online surveys are a suitable assessment data collection method to use in the SMPA approach.

There are a number of inherent strengths of online surveys in comparison with other assessment data collection methods such as interviews and document reviews. Firstly, surveys are ideally capable to measure a wide variety of unobservable data (Bhattacherjee 2012). Process assessment data comprise information about process inputs, process outputs, perceptions of business value of the process, process activities undertaken, process knowledge and process documentation among other things. Therefore, observing process activities, reviewing process documents and asking people about their work during a face-to-face interview may not reveal real and honest responses since these assessment methods are obtrusive in nature. An online survey can solicit unobservable data with limited interference in the respondent's day-to-day operations.

Due to the unobtrusive nature and the ability to respond at one's convenience, surveys for assessment data collection can be a preferred option. Surveys can be completed at any time and place during the assessment period. Online surveys with capability for multi-sessions would enable survey participants to respond to questions in a relaxed environment, resulting in time savings for both themselves and the assessment facilitator. Due to the reduction in time given for data collection, the assessment facilitator could spend more time with the assessment participants discussing questions of interest or confusion. This would enable all IT service staff to focus on their daily business and make ongoing online assessments a normal part of their work. In this way, online surveys can be economical in terms of assessment time, effort and cost compared to other methods.

It has been reported that the approach of asking questions directly in a web-based survey environment represents a faster and efficient data collection in service research (Deutskens, de Ruyter & Wetzels 2006). Since ITSM process assessment collects data about the behaviour of peoples' work (processes), it is pertinent to a psychological study. This is why each question begins with the phrase: "Do you know …?" All questions relate to finding the respondent's knowledge about the question at hand. Use of online surveys in psychological studies has been linked with efficiency due to automation that also enables expansion of the scale and scope of such studies (Kraut et al. 2004). Moreover, online surveys can gather credible data input even from the introverts in an organisation who respond best in quiet environments as discussed by Cain (2013). Online surveys are also ideally suited for remote data collection from a global IT workforce as compared to document reviews or interviews. The prevalent growth of outsourcing of IT service functions and the use of virtual IT teams across the globe means that online surveys can be a suitable assessment data collection tool to perform ITSM process assessments.

6.4.4 Reflection on Research Work Concerning RQ2

The RQ2 discussion suggested that the evaluation of usability of the SMPA approach was conducted in an objective manner by following the international standard for software quality in use model ISO/IEC 25010. Based on the entire evaluation experience and some comments and suggestions by case study participants, a number of issues encountered during artefact evaluation are worthy of reflection.

Firstly, the link to the online survey was distributed at the end of a lengthy email that included participant information and instructions on how to complete the survey. **Appendix D.4** (p. 251) presents the online survey email format. The case participants found the assessment link near the end of the email and clicked through the link for the survey. Hence, some participants missed important information regarding the survey as they scrolled through the email. This researcher had several conversations with the assessment facilitators at both case study organisations to explain and clarify several queries about the online survey. It was realised later during the evaluation that it would have been better if the instructions were detailed as an introduction page at the start of the survey rather than in the email. The assessment facilitators at both case study organisations agreed that the instructions were more likely to be read in the survey introduction page rather than in a long email.

Upon reflection, it was also noted that all questions do not apply well to the processes and there is a need to provide clearer answer options and better allocation of some questions to relevant process roles. The majority of negative comments about the usability of the SMPA approach referred to the lack of representative and understandable assessment questions in the online survey. While attempting to align the questions to the indicators from the ISO/IEC 15504 standard, the questions needed to be more relevant and clear. It would have helped to have relevant examples for each of the assessment questions for every process. There were few assessment questions that had examples but the majority of them did not have relevant examples specific to the process, particularly at higher capability levels. Consequently, the evaluation results confirmed that survey respondents found the assessment questions became more difficult to understand as they progressed to higher capability level questions.

It can also be argued that the difficult questions at higher capability levels for every process could have been due to fatigue while answering a large number of assessment questions. For a single individual in multiple roles over several processes, there were a substantial number of questions to answer from different perspectives. This is particularly true for TRC ICT since this organisation had a number of staff working on several processes in different roles and the processes were assessed up to CL5.

It should be noted that TRC ICT only agreed to assess up to CL5 to enable full testing of the SMPA approach. In a production environment, TRC ICT would have limited the scope of the assessment to CL3. In such a scenario, the assessment questions would have been less in number and easier to understand. As a result, the assessment report would have been less lengthy as well. Therefore, one recommendation for technology diffusion of the SMPA approach is that the organisations should carefully scope the processes and capability levels for ITSM process assessment.

There was an ongoing concern regarding the participation of CITEC as a pilot evaluation site. In 2012, the then newly-elected Queensland State government announced its plans to divest the organisation. Despite radical staff turnover at CITEC, the SMPA trial and evaluation were performed and a manual assessment conducted.

During evaluation, the majority of the survey respondents supported the inclusion of goal statements at different sections of the survey. The goal statements specified the purpose of assessment, process attribute being assessed, process role and context of assessment based on the GQM template (Van Solingen et al. 2002). Another explanation for the lack of clarity in the higher capability level questions is perhaps due to the confusion regarding information about the goal statements. It is easy to lose track of the roles and perspectives one should be taking while answering the assessment questions. It would have been better if the information about the goal statement was provided on the screen for all the assessment questions. This may have ensured that the survey respondent is always aware of the roles and perspectives he/ she should take while answering a particular question.

Another issue to reflect on regarding the RQ2 discussion is the use of the RAPID assessment (Cater-Steel, Toleman & Rout 2006) to compare with the SMPA approach for the artefact evaluation. It may have been better if the assessment team in this research had conducted a full ISO/IEC 15504 assessment instead of the RAPID assessment. The research team had resources to conduct a full assessment as certified lead assessors were available. However both case study organisations did not commit adequate time and resources to a full process assessment exercise that would require several days of engagement and multiple types of objective evidence (multiple interviews, document reviews, ITSM tool review) to be presented. This is in itself a testament to the need for efficiency in the way ITSM process assessments are conducted. The RAPID assessment was based on a single objective evidence type – interview testimony – and was assessed up to CL3 only. However the RAPID assessment is fully compliant with the ISO/IEC 15504 standard. Nevertheless, a full assessment would have ensured a more objective comparison and subsequent evaluation of the SMPA approach against the standard.

Finally, different process stakeholders of the SMPA approach commented on the usability of the artefact based on their context of use. However this research has not analysed the context of use for different process roles of process stakeholders. One of the observations at CITEC during focus group discussions was that all the participants commented that the assessment questions were very ‘academic’. Upon reflection, it can be argued that since the SMPA approach was implemented as a part of an academic project, it was perhaps this context of use that influenced case study participants’ responses to the assessment questions. Moreover, a large number of comments received during the online survey did not relate to the process being questioned. These comments were provided as feedback on the research work. In other words, several comments were targeted at the research project rather than the process issues at the organisation. Upon reflection, this researcher believes it is another instance of misperception due to the context of use aspect of usability evaluation as suggested by the standard (ISO/IEC 2011a).

6.4.5 Prominent Theme Emerging from RQ2

During research work on RQ2, the SMPA approach was evaluated in a case study research at two IT service providers. In terms of immediate results of artefact evaluation as discussed in RQ2 findings, it was reported that the SMPA approach was trustworthy, comfortable and generally effective. Positive comments were also recorded regarding the efficiency of the SMPA approach.

However discussions on RQ2 led to the emergence of a central theme that a fully automated SMPA approach that is strictly standards-based is not very useful. It was discussed that human input is critical for the diffusion of the SMPA approach as a technology innovation in the two case study organisations. While technology innovation of SMPA approach can be diffused in IT service organisations, the activities surrounding ITSM process assessments that require questioning of staff attitudes and opinions regarding their work behaviour and then making a judgement about the capability level of such processes cannot be solely decided by technology.

Based on these discussion points, it is recommended that measures should be taken to provide assessment support through expert assessment facilitators, online discussion forums and/ or help screens in order to clarify survey questions with relevant examples when needed. For a successful innovation diffusion, it is important to appreciate the role of a facilitator in the SMPA approach to assist at every phase of the SMPA approach: (a) phase 1 – facilitating discussions during process selection; (b) phase 2 – clarifying questions and responses with relevant examples and references from ITIL framework; (c) phase 3 – providing justification of process capability scores and using the facilitator console; and (d) phase 4 – explaining the assessment report sections and discussing the implementation of process improvement recommendations where applicable.

Combining the SMPA approach with manual process assessment for successful diffusion of innovation as a hybrid approach is the major theme emerging from the discussions of RQ2. A central design knowledge that transpired from RQ2 discussions is that measuring process capability is a convoluted activity. However the two case study organisations did not report that the assessment measurement precision was an issue. Process managers from both organisations were more interested in using the assessment results taken as a whole to improve the processes. In this context, RQ2 discussions led to a conclusion that a hybrid approach, combining the strengths of the SMPA approach and manual assessment, can support the SMPA approach for effective implementation and subsequent use in the organisations. From the view of the DOI theory (Rogers 1995), the hybrid approach may enable the final stage of innovation diffusion, i.e. the confirmation stage during innovation diffusion in organisations.

The SMPA approach can address the research problem and can be used for a series of self-assessment exercises. However for the clarification of the assessment questions and expert guidance on the implementation of process improvement recommendations, expert assessment facilitators and subject matter experts/ consultants from the ITSM discipline are required. The SMPA approach is not suitable for audit and certification of ITSM processes. Nevertheless the SMPA approach may be a useful tool for external assessors in order to conduct assessments. In summary, a hybrid approach combining the SMPA approach and manual assessment means that these two exercises may complement each other well.

6.5 Discussion of RQ3: Artefact Outcome Evaluation

RQ3 asked if the outcome of the research artefact is usable to make process improvement decisions by IT service organisations. In this research, phase 4 of the SMPA approach represents the outcome of the research artefact. More specifically, the assessment report generated by the DSS in the SMPA approach, or simply the SMPA report is the outcome of the artefact. The SMPA report was presented to the process managers at each of the case study organisations and then evaluation questions were asked regarding expected decision quality and expected decision efficiency from use of the report to make process improvement decisions. Temporal constraints of this research project meant that actual decisions made on process improvements based on the report, and the actual impact of the report on process improvements and CSI could not be evaluated. Chapter 5 reported the evaluation of phase 4 of the SMPA approach to answer RQ3 in terms of expectations of process managers from the SMPA report.

Table 6.4 lists a summarised view of evaluation findings about the expectations to make process improvement decisions based on the SMPA report from all process managers at both case study organisations.

Table 6.4 Consolidated Evaluation Findings for RQ3

Usability factor	**Assessment report (phase 4)**
Effectiveness	☑
Efficiency	☒
Usefulness	☑
Trust	☑

☑ indicates the usability factor was strongly supported by the majority of participants
☒ indicates the usability factor was strongly opposed by the majority of participants

According to the four usability factors used to evaluate the outcome report, one of the most significant findings is that most process managers expected that better quality decisions about process improvements can be made from the SMPA report. It was also found that the process managers considered the expected utility and trust of the SMPA report to be highly positive. However it was surprising to find that most process managers expected that considerable time and effort would be required to make decisions on process improvement based on the SMPA report, therefore making the report inefficient to use. The generation of the report is almost instantaneous as the DSS can produce the report as soon as the assessment data are collected. However the process managers thought that the assessment report is time consuming to read and implement. Chapter 5 presented these findings in detail. Based on this premise, three discussion points related to the findings of RQ3 are presented next.

6.5.1 Assessment Report - SMPA Approach vs. RAPID Assessment

Most of the negative comments regarding the SMPA report’s expected lack of efficiency are based on the simple fact that the SMPA report had substantially more pages than the assessment report from the RAPID assessment, hereafter referred as the manual report. This is not necessarily a negative feature of the SMPA report since the SMPA approach had a larger number of assessment questions (and subsequent process improvement knowledge items) than the RAPID assessment. However the process managers were adamant that although the SMPA report is very informative, the report is very difficult to understand and use in comparison with the manual report. The manual report is considered efficient to understand and act upon.

Moreover the assessment profiles presented in the SMPA report and the manual report are very different. The SMPA report appeared to take a strict stance to measure process capability and provided lower process capability scores than the manual report. This is largely due to the mechanistic approach to calculate process capability scores adopted by the SMPA approach. This researcher considered that identification of the process gaps and recommendations for process improvement are more important sections of the SMPA report rather than the actual capability scores. This is why the SMPA report is not intended to be used for audit or certification, but as a checkpoint between assessments to determine process improvement and CSI.

In Chapter 5, Table 5.8 and Table 5.10 presented the assessment profiles of the two organisations from the manual report. Likewise, Table 4.26 and Table 4.27 of Chapter 4 presented the assessment profiles of the two organisations from the SMPA report. In an attempt to account for the dramatic differences between the manual report and the SMPA report, the following four reasons are suggested.

Firstly, during a manual assessment, a competent lead assessor makes the final decision on process capability levels and process improvement recommendations to be included in the assessment report (Van Loon 2007). The influence of the lead assessor in the manual assessment may introduce bias resulting in judgment based on previous experience, a set of underlying assumptions, and perceptions and interpretations while determining the scores. Such bias is absent in the SMPA approach since the DSS uses a transparent approach to calculate the process scores.

Second, the manual assessment was conducted in a group discussion environment including stakeholders from all roles for a particular process. Peer group discussions may be biased since senior managers and extroverts may dominate the discussion and assert their opinions. This behaviour may lead to a lack of insightful contribution from other process stakeholders due to inactive participation (Cain 2013). This limitation is removed in the SMPA approach as everyone had an anonymous and equal say about the processes in a more democratic manner through online surveys, therefore improving accuracy in depicting the true picture.

Third, assessment questions were more granular in the SMPA approach. While the manual assessment focused on high level discussions and the assessors’ judgment of specific assessment indicators based on those discussions, the SMPA approach focused on the standard asking very specific questions for every indicator to determine the process capability. A more granular approach improves the authenticity of the SMPA approach. However this also means a significant time imposition for survey respondents by examining specific aspects of a process in detail, resulting in confusion when dealing with specific questions of a technical nature as reported during artefact evaluation.

Finally, process recommendation items were larger in number and more detailed in the SMPA report in comparison with the manual report. This is again due to the granular architecture of the SMPA approach where recommendation items were derived from the ITIL framework and stored in a knowledge base for each assessment question. For every instance of process area risk, a recommendation item is triggered from the knowledge base and compiled in the SMPA report. In contrast, the manual assessment reported a limited set of action items that highlighted only the most important areas for improvement. In this research, the number of recommendations provided in the manual report for any process was only six at most.

On top of the general considerations to explain the differences between the manual report and the SMPA report at both case study organisations, it was observed that TRC ICT had two additional factors that might have affected the results from the two assessment methods. First, at TRC ICT, due to staff turnover, different staff participated in the two assessments. The manual assessment had ten participants and the SMPA survey was completed by eleven respondents. Only three process stakeholders (T-ChM-PM1, T-PrM-EPS1 and T-ChM-PP2) participated in both assessments. Second, at TRC ICT, the time lag between the two assessments was six months and significant changes during this time such as the implementation of a new ITSM tool might contribute to changes in process capability ratings. This research did not study the organisational and individual factors contributing to the outcome of the artefact in detail, however the impact of these factors cannot be ignored.

The differences in the assessment reports is a very interesting observation in this research and this was reviewed with input from S1 regarding the usability of the SMPA approach. However the focus of the evaluation in RQ3 is solely on the SMPA report rather than an evaluation of the differences between the SMPA and manual reports or for strict compliance with the ISO/IEC 15504 standard. The two assessment reports come from two completely different methods even though both use the assessment model and measurement framework based on ISO/IEC 15504. A comparison of the outcomes of two different assessment methods was not part of the outcome evaluation of the artefact in this research. Instead this research focuses on naturalistic evaluation by obtaining feedback from process managers on the usability of the SMPA report.

6.5.2 Discussion of Artefact Outcome Evaluation: A Logic Model Structure

Evaluation of the use of technology to support rational decisions with a causal link between beliefs, attitudes and intentions has been researched in the IS discipline in great detail. One of the widely accepted models to test intention to use a technology is the Technology Acceptance Model (TAM) developed originally by Davis (1989). TAM used the theory of reasoned action by Ajzen and Fishbein (1980) to define attitude measures such as “perceived usefulness” and “perceived ease of use” to explain people’s attitudes to technology adoption (Davis 1985). Alternative theories frequently used to explain the use of technology in IS research are the Theory of Planned Behaviour (Ajzen 1991); the Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003); the Task-Technology Fit theory (Goodhue & Thompson 1995); Diffusion of Innovation Theory (Rogers 1995) and the

Delone and McLean IS Success Model (Delone & McLean 2003). These theories examine independent variables such as "technology acceptance", "technology fit", "technology implementation", "technology intention to use" or "technology success" for evaluation. There is a lack of a consistent definition of constructs in IS research to study the outcome of technology use (Furneaux & Wade 2009). PVT theory (Overby 2008) states that the quality of the outcome can be measured to determine virtualisability of a process. Therefore, the process followed in the SMPA approach can be evaluated for quality of its outcome, i.e. the SMPA report. Such outcome evaluation is represented in the research work related to RQ3.

Beyond providing a strategic evaluation framework (Venable, Pries-Heje & Baskerville 2012) or a holistic view of important evaluation methods (Prat, Comyn-Wattiau & Akoka 2014), there is very little guidance provided to researchers in DSR to discuss artefact outcome evaluation and its impact. As a response, a simple logic model is used in this research to discuss artefact outcome evaluation. The logic model has been used by program managers and evaluators for over three decades to describe the effectiveness of their programs. In its simplest form, the logic model displays logical relationships between the inputs, activities, outputs and outcomes of a program (Julian, Jones & Deyo 1995). Logic modelling methods such as program logic are used extensively for performance evaluation of programs (McLaughlin & Jordan 1999). Consequently the logic model is featured as one of the qualitative evaluation research methods (Patton 1990). Discussion related to the impact of the artefact outcome evaluation can be structured using the logic model.

A logic model for the discussion of artefact outcome evaluation is presented in Figure 6.2. The logic model presents a unified view of (1) inputs in terms of the artefact to evaluate and the evaluation strategy adopted; (2) discussion of participation and activities to clearly explain the evaluation process; and (3) evaluation findings in terms of immediate outcome findings, short-term impacts and long-term impacts of the artefact outcome evaluation.

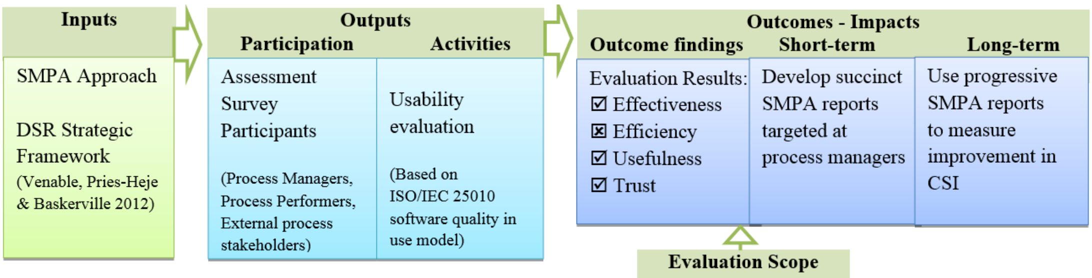

Figure 6.2 Logic model for Artefact Outcome Evaluation

A clear definition of the artefact to be evaluated is necessary to provide context for the evaluation effort. Artefact description is already reported in Chapter 4. Likewise, the evaluation chapter (Chapter 5) reported use of the DSR strategic evaluation framework (Venable, Pries-Heje & Baskerville 2012) as the evaluation strategy. Evaluation was based on the ISO/IEC 25010 software quality in use model (ISO/IEC 2011a) to determine the usability of the SMPA approach (RQ2) and the outcome of the SMPA approach, i.e. the SMPA report (RQ3).

There are three dimensions of evaluation findings: immediate findings; short-term impacts; and long-term impacts of the outcome evaluation. These dimensions provide three scope demarcations to discuss varying levels of impacts of the SMPA report. The logic model in Figure 6.2 enables discussion of the usability of the SMPA report (RQ3 findings).

While reporting iterative “build-evaluate” cycles, i.e. the *ex-ante* evaluation process, discussion of the SMPA approach was limited to immediate evaluation results. Such formative evaluations are usually reported as part of artefact design and description (Vaishnavi & Kuechler 2004). These evaluation checkpoints were discussed in Chapter 4. Likewise, Chapter 5 reported summative evaluation of the entire SMPA approach. RQ3 is focused on the evaluation of phase 4 of the SMPA approach, i.e. the SMPA report. To answer RQ3, immediate evaluation results are reported as outcome findings of the SMPA report. The outcome evaluation results for RQ3 are listed in Table 6.4.

The scope of artefact evaluation is limited to the immediate outcome findings in this research. As shown in the logic model in Figure 6.2, short-term impacts and long-term impacts can be empirically evaluated but this is not undertaken as part of this research. Hence key discussions relating to the short-term and long-term impacts of artefact outcome evaluation are inferred and briefly discussed next.

More elaborate discussions on outcome evaluation findings and their implication on practice can be structured as short-term impacts of the SMPA report. In response to negative expected decision efficiency for the SMPA report reported during outcome evaluation, the structure and content of the SMPA report can be modified for clarity. Since the outcome evaluation findings suggested that the process managers are confused with the SMPA report, it can be deemed that the report is not very useful for decision-making on its own and needs further development. Changes in the report template, presentation of assessment results and listing of process improvement recommendations have been suggested to address the shortcomings of the SMPA report. Hence, further work needs to be done to make the SMPA report succinct and targeted to the main audience of the report – the process managers. The report must provide clear rationale and directions to the process managers to implement process improvements. This research did not proceed to evaluate the process improvement activities based on the SMPA report, however it is realised that the major impact of the SMPA report in the short-term is towards its impact on the effective implementation of process improvements.

Likewise, long-term evaluation outcomes may comprise lasting impacts and implications to theory and the body of knowledge as a result of outcome evaluation. Even though the SMPA approach provides recommendations for process improvement, the ultimate decision to enact process improvements is made by the incumbent decision makers of an organisation. Moreover, to address construct validity, the online surveys in the SMPA approach should be able to collect information from different process stakeholder groups (process performers, process managers and external process stakeholders) otherwise the process capability scores may be biased.

In the long run, a series of SMPA reports from periodic assessments can be used to measure improvements in CSI. The continuous improvement principle of the Total Quality Management (TQM) philosophy (Powell 1995) can be used to explain the long-term impact of the SMPA report for ongoing improvement of processes, systems and organisations in ITSM. *Section 6.5.3* discusses an assessment-based process improvement approach for CSI that relates to the long-term impact of outcome evaluation of the SMPA report.

In summary, artefact outcome evaluation based on a linear logic model provides a potential integrative framework for the discussion of research impacts in a DSR study.

6.5.3 Assessment-based Process Improvement: A CSI Approach

True to the old management adage "you can't manage what you don't measure," the measurement of processes for improvement may ultimately facilitate service improvements (Cannon 2011). From an investment point of view, ITSM represents a serious commitment by organisations with some investing more than half a million dollars to implement new IT service delivery frameworks (Deare 2006). However, it is still a challenge to measure benefits of ITSM (Gacenga et al. 2011; Seddon, Graeser & Willcocks 2002). A cycle of planning, measuring, monitoring and implementing improvements is hence required and this cycle is prescribed in the CSI concept (Lloyd 2011). This concept is inspired by the PDCA cycle (Moen & Norman 2006) that has been adapted in the service lifecycle phases of ITIL (Lloyd 2011) and the service management systems of ISO/IEC 20000 (ISO/IEC 2011b).

Process assessments are useful in all four phases of the PDCA cycle: (a) plan – baseline assessments of process performance; (b) do – implementation phase to execute process improvement based on the assessment reports; (c) check – the measurement phase to track the progress made and conduct further process assessments; and finally (d) act – the final action phase that completes the feedback loop in process improvement and provides support for service improvement on a continual basis. Hence, at a process level, the role of process assessments in the PDCA cycle is paramount.

Based on the PDCA cycle, a CSI 7-step improvement process has been prescribed in the ITIL framework (Lloyd 2011). However, ITSM process assessments are criticised in the ITSM community for producing an assessment report that only shows scores, such as process capability levels (McGlynn 2013). The SMPA approach attempts to address this criticism with the help of a knowledge base. The reporting feature of the SMPA approach selects specific recommendations for process improvements by inspecting the process gaps at the question level. A cumulative recommendation set for a process is therefore developed from all the assessment indicators that demonstrated risks. However the SMPA report is not proposed as a turnkey solution for process improvement since an implementation plan for process improvement is not included. Instead process improvement activities require periodic process assessments for measurement (Malzahn 2009). This leads to the view that process improvements can be ideally evaluated through repeated assessments.

Assessment-based process improvement is typically carried out in four steps: (a) baseline assessments; (b) planning of process improvement; (c) implementation of process improvement; and (d) checkpoint assessments (HM&S 2014b). The approach of conducting periodic assessment for process improvement has been reported in the field of software process improvement for small firms (Cater-Steel, Toleman & Rout 2005) and project management (Malzahn 2009). Discussions of RQ3 can propagate the impact of the SMPA report to facilitate periodic assessments in ITSM.

The continuous improvement principle of TQM is already applied in the ITSM discipline based on the presence of CSI in the ITIL service lifecycle (TSO 2011). The SMPA approach is focused on process assessment, however it is important to understand the impact of ITSM process assessments on CSI. This is similar to exploring a link between task performance and organisational performance which has received limited attention in the IS literature (Furneaux & Wade 2009). A collection of individual ITSM process improvements can contribute to CSI.

Bernard (2012) warned that process assessments do not give insight into the cultural dynamics of an organisation and can be a goal in themselves instead of a means to an end due to their labour-intensive and expensive nature. Moreover, the assessment reports depend on the subjective judgement of assessors (Bernard 2012). Therefore the SMPA report – developed using a transparent and efficient ITSM process assessment method – is also positioned to support a transparent and efficient CSI. Following the discussions of RQ3 to ascertain long-term impacts of the SMPA report, process managers can use improvement metrics such as critical success factors and KPIs to improve ITSM processes and services at their organisations.

6.5.4 Reflection on Research Work Concerning RQ3

The usability of the outcome of the research artefact, i.e. the SMPA report, was evaluated in RQ3. The immediate evaluation findings and a number of short-term and long-term impacts of the outcome to ITSM process assessments, process improvements and CSI were discussed in the previous section. Key reflection points encountered during the research work relating to RQ3 are mentioned next.

Firstly, it was very important to clearly determine the ownership of the SMPA report. It was realised that the confidentiality of assessment results is highly critical since the assessment report remains the intellectual property of the assessed organisation (Hilbert & Renault 2007). Based on the ethics approval of this research, assurances were provided that the assessment report would be delivered only to designated people. The SMPA report was emailed to the assessment facilitators at each case study organisation. No other process managers were provided with copies or extracts of the report. It was left to the discretion of the assessment facilitator to distribute and use the SMPA report according to their organisation policies.

On a different note, it was interesting to contemplate that the evaluation of the SMPA report at TRC ICT resulted in relatively more positive findings than at CITEC. The primary reason for positive outcome evaluation at TRC ICT could be the fact that this researcher went through the structure of the SMPA report and discussed how to understand the report with the assessment facilitator at TRC ICT. Subsequently, all three process managers of TRC ICT had an internal meeting to discuss their position on the SMPA report before the one-on-one evaluation interviews. In contrast, a meeting request to discuss the assessment report findings was rejected by CITEC. Consequently, the process managers at CITEC seemed more confused about the SMPA report during the evaluation interviews. The fact that the process managers at CITEC did not have the opportunity to review the report together might have contributed to this situation. Therefore the presentation and explanation of the SMPA report structure and logic appears to be a very important activity. This also suggests that the SMPA report is not very clear to understand on its own. This interpretation is in line with the evaluation findings of the lack of expected decision efficiency from the report.

Reflecting on the discussions from RQ3, it is found that the SMPA report ignored further analysis of the “Do Not Know” (DnK) and the “Do not understand the Question” (DnQ) responses. A count of the DnK and DnQ responses were provided, however the SMPA report could further report the implications of a large number of

DnK and DnQ responses. A substantial number of DnK responses for a question by all respondents would suggest miscommunication regarding process activities. Process managers would be interested to review this metric to correctly inform process stakeholders about the concerned process indicator. The corresponding process improvement recommendations are not triggered for DnK responses. In retrospect, it would have been a sound idea to list a set of recommendations for high DnK responses in the SMPA report. This would have made process managers aware of the issues that most process stakeholders do not know about. DnK responses are perhaps an equally risky proposition as the 'No' responses. Similarly, the DnQ responses could be screened out to review the questions and develop a new version with relevant examples where applicable.

Finally, the process managers were overwhelmed by the sheer depth of information in the SMPA report in comparison with the manual report, resulting in their evaluation of the lack of expected decision efficiency in the SMPA report. Rather than providing a complete list of process improvement recommendations for all process gaps at every capability level, it would have been more valuable if the SMPA report provided summary information, such as listing only the top five or ten process improvement recommendations at certain capability levels instead of all. A suitable approach to trim the SMPA report to a reasonable report size would have reduced the information overload of the process managers.

6.5.5 Prominent Theme Emerging from RQ3

The RQ3 evaluation was limited to the immediate findings of the usability of the SMPA report. Short-term and long-terms impacts of the SMPA report were discussed in the previous sections. The impact of the SMPA report is beyond the research area of ITSM process assessment. Akin to the systems approach to continuous improvement proposed in the Theory of Constraints (Goldratt & Cox 1992), RQ3 discussions can lead to a systems view of the impact of the SMPA report that can propel CSI in ITSM organisations.

The Theory of Constraints suggested that the continuous improvement principle cannot be solely determined by improving processes without understanding the interactions of the processes as a system (Dettmer 1997). In the same note, the rationale to conduct ITSM process assessments must be justified by viewing it as a systems approach to seek its connection with CSI. In Chapter 2, the literature review demonstrated the scholarly journey from the "quality" and "service" disciplines to the specific research topic of ITSM process assessment. For the main theme to emerge from the discussions of RQ3, an opposite journey must be envisaged to understand the implications of the SMPA approach towards the principles of service and quality literatures.

The central theme of the RQ3 discussion is the realisation that the use of the SMPA approach in IT service organisations is only one step in a long and ongoing improvement journey. If the outcome of the SMPA approach is not supported by an improvement approach, the IT service organisations will only have a system to identify the problems but they will not have any support for service improvement (Malzahn 2009). In order to close this gap, the SMPA approach must reach out to be a part of CSI. An ideal application of the SMPA approach in IT service organisations towards CSI was represented in Chapter 4, Figure 4.3. The result is an environment that provides initial assessment before continuous improvement opportunities with checkpoint assessments for review. CSI can represent such an environment. This principle has been prominently discussed not only within the ITSM discipline (TSO 2011) but in other quality disciplines such as the continuous improvement methods in TQM (Powell 1995) and the principle of continuous improvement in the ISO 9000 standard (Marquardt & Juran 1999).

One of the key principles of TQM suggests that process deficiencies are the root cause of most of the mistakes made by individuals in an organisation. By improving the processes, repetition of such mistakes can be prevented (Gilbert 1992). In order to improve processes, ongoing assessments are a requirement for CSI in the ITSM discipline (Lloyd 2011). The SMPA approach is proposed to enable repeated assessments by promoting transparency and efficiency in the way ITSM process assessments are conducted. While the continuous improvement concept such as Deming's PDCA cycle promotes constant refinement and improvement, the SMPA approach supports repeated measurement of process improvement in a consistent manner. According to the continuous improvement literature, organisations can only advance to a new level after an earlier status has been achieved (Bessant & Caffyn 1997). Such an incremental, step-by-step improvement approach is consistent with the views of CSI where ITSM organisations review their past decisions and make better decisions through gradual process improvements. Therefore, the major theme of RQ3 is that the repeated use of the SMPA approach facilitates CSI in ITSM.

6.6 Chapter Summary

This chapter provided a high-level discussion of the design, development and evaluation of the SMPA approach through the research questions. The chapter highlighted the direction taken in this research to discuss the development and intended use of the SMPA approach to address the research problem. Discussions on the evaluation of the usability of the SMPA approach and its outcome confirmed the utility and impact of the research artefact.

The discussions highlighted research rigour by using theoretical guidelines and empirical case study evidence to demonstrate key findings and what the findings mean in the defined research context. Table 6.5 lists the research questions and the main themes that emerged from their discussions based on underlying theoretical support.

Table 6.5 Main Theme and Theoretical Underpinning from RQ discussions

Research question	**Main theme after discussion**	**Underpinning theoretical support**
RQ1	Virtualisability of ITSM process assessment	Process Virtualization Theory (Overby 2008)
RQ2	Innovation diffusion of a hybrid approach	Diffusion of Innovations Theory (Rogers 1995)
RQ3	Repeated assessments for continuous improvement	Theory of Constraints (Goldratt & Cox 1992) and Total Quality Management (Powell 1995)

Highlighting the new direction taken in this study, in advancing previous literature findings, this chapter discussed the context and relationships between the justified research problem and empirically tested artefact solution to the research problem.

A discussion of the research questions also highlighted how this research addressed the challenges in practice through an academic endeavour. Discussion of the answers to the research questions provided a meaningful set of design knowledge from the DSR study. Based on the design knowledge obtained, the contribution of the study to research and practice in the area of ITSM process assessment is presented in the final chapter, Chapter 7 Conclusion.

Chapter 7. Conclusion

7.1. Chapter Introduction

This chapter provides a conclusion to this thesis with a summary of the key research findings to demonstrate how this research has met its objectives. This is followed by an account of the contributions of the research to theory and practice. The DSR knowledge contribution framework presented by Gregor and Hevner (2013) is used to position the contributions to the body of knowledge. Finally, the chapter also states the limitations of this research and directions for future research.

This chapter is organised into six sections. This section is an introduction to the final chapter. A summary of the research findings is provided in *section 7.2*. The contributions this research makes to theory and practice are presented in *section 7.3*. Limitations of the research are provided in *section 7.4*. Directions for future research are suggested in *section 7.5*. The final chapter summary is provided in *section 7.6*.

An overview of the chapter is shown in Figure 7.1.

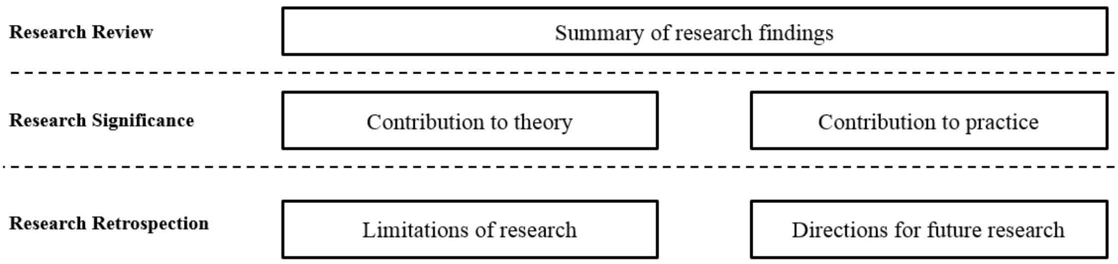

Figure 7.1 Chapter 7 Overview

7.2. Summary of Research Findings

The ITSM industry has defined a number of processes as best practices in the ITIL framework and the international standard for ITSM, ISO/IEC 20000. However, academic literature on the measurement of ITSM process improvement is scant. The ITSM industry also reports a lack of a transparent and efficient process assessment method to improve ITSM processes. This research aims to address the dual problems of the lack of transparency and the need for efficiency in ITSM process assessment.

Using the DSR methodology, an iterative design process was followed to develop a research artefact: the SMPA approach that enables researchers and practitioners to assess the ITSM processes in a transparent and efficient way. The four phases in the SMPA approach include preparation for the assessment; online survey to collect assessment data; measurement of process capability; and reporting of process improvement recommendations. The international standard for process assessment ISO/IEC 15504 and associated assessment models provided support for a transparent method. A DSS was implemented to demonstrate efficient use of the SMPA approach. Using a theoretically-grounded fit profile based on TTF theory, the international standards and DSS technology were implemented in the SMPA approach to address the research problem.

The evaluation of the SMPA approach was conducted at two case study organisations. The two organisations are the Queensland Government's primary IT service provider, CITEC and the IT service department of an Australian local government authority, Toowoomba Regional Council. Using the international standard for software quality models from ISO/IEC 25010, the usability and outcomes of the SMPA approach were evaluated. Evidence from the case study evaluations indicated that the SMPA approach is usable for ITSM process assessment in order to support decision-making on process improvements.

Further discussions of the research findings provided design knowledge that included the emergence of the concept of virtualisability in ITSM process assessments and a proposal of a hybrid ITSM process assessment method. It is often difficult to determine how well ITSM processes facilitate CSI (Lloyd 2011). In such a scenario, iterations of self-assessments of ITSM processes using the SMPA approach may facilitate CSI.

This research study is reported in seven chapters. Chapter 1 presented the background to the research and the motivation to be involved in this research. Moreover, the research problem, research questions and justification of the research along with expected research contributions were highlighted in Chapter 1. Three research questions that relate to the development and evaluation of a proposed research artefact were formulated to respond to the research problem. Chapter 1 also presented an introduction to the methodology, definition of key terms, scope delimitations and key assumptions of this research.

In Chapter 2, a literature review strategy was used to review academic, industry, theoretical and empirical studies related to ITSM process assessment. Likewise, the parent disciplines of quality and service were reviewed to develop a literature classification model for ITSM process assessment. Prior academic and industry studies on ITSM process assessment were reviewed to highlight the gaps in literature in order to justify the research problem and the three research questions. Chapter 2 identified two research opportunities based on the literature review findings. A brief overview of the research artefact and the international standards associated with the artefact was provided before a research model was presented in the chapter conclusion.

Chapter 3 described and justified the research philosophy, research design and the DSR methodology applied in this research. Chapter 3 also presented the concepts of design theory and kernel theory as applicable to this research. The TTF theory in particular was presented in detail since it is the primary kernel theory in this research. The planned research activities to answer the three research questions were also presented in Chapter 3. Finally, the justifications for the research approach along with ethical considerations made in this research were provided.

In Chapter 4, design principles for the development of the research artefact were articulated first before outlining the structure of the SMPA approach. Each of the four phases of the SMPA approach were described in terms of the method description, DSS implementation and finally demonstration of the phase at the two case study organisations. Chapter 4 answered RQ1 after discussing the iterative design process to report the artefact design, development and demonstration.

Chapter 5 used an evaluation strategy to develop the protocols for the evaluation of the artefact and the research process. Detailed evaluation of each of the four phases of the SMPA approach along with the technical evaluation of the DSS platform were presented in Chapter 5. RQ2 and RQ3 were answered in Chapter 5 through the evaluation findings of the usability and outcome of the SMPA approach for two organisations featured in case studies.

In Chapter 6, a discussion of the interpretation of the research findings was presented within the context of the research method and reviewed literature. Chapter 6 discussed the findings in terms of each of the three research questions along with a reflection on research work conducted and the presentation of key themes that emerged from this research.

The study answers the three research questions as below.
RQ1. How can a software-mediated process assessment (SMPA) approach be developed for transparent and efficient process assessments in IT service management?
This research confirmed that the existing guidelines for ITSM process assessment lack transparency and efficiency. With the help of a fit profile (Chapter 4, Table 4.2) based on the TTF theory, the requirements for a transparent and efficient ITSM process assessment and the DSS technology features to address such requirements were discussed to develop design principles for the SMPA approach. Four phases of the SMPA approach are Phase 1 preparation – for scoping the assessment project; Phase 2 survey – for assessment data collection using online surveys; Phase 3 measurement – for calculating process capability scores; and Phase 4 improvement – for generating process improvement recommendations in a report. A detailed structure of the DSS for the SMPA approach was presented in Chapter 4, Figure 4.4. An account of the design, development and demonstration of the SMPA approach in Chapter 4 answered RQ1.

RQ2. How fit for use is the SMPA approach in IT service organisations?
This research developed evaluation strategies and protocols based on the DSR strategic evaluation framework presented by Pries-Heje, Baskerville and Venable (2008). Two case study organisations – CITEC and TRC ICT – were employed for the evaluation of the SMPA approach. The evaluation was conducted through focus group discussions and interviews to obtain experience feedback on the usability of the four phases of the SMPA approach. Usability was evaluated in terms of effectiveness, efficiency, usefulness, trust and comfort measures as defined in the ISO/IEC 25010 software quality in use standard model. Evaluation results revealed that the SMPA approach is effective, efficient, trustworthy and easy to use. However, usefulness of the SMPA approach (Phase 2 survey) was questioned since the majority of participants suggested that the assessment questions were not representative of what they do and very hard to understand. The results of usability evaluation of the SMPA approach answered RQ2.

RQ3. How fit for use is the outcome of the SMPA approach (assessment report) to support decision-making on process improvements?
This research further extended the evaluation of the SMPA approach to determine usability of the outcome of the SMPA approach. The outcome of the SMPA approach is the SMPA report. The SMPA report was presented to the process managers at each case study organisation. Process managers were asked evaluation questions to

determine if they expected the SMPA report to support their decision-making on process improvements. Evaluation results suggested that the SMPA report can be expected to make more effective process improvement decisions and is trustworthy and useful. However the process managers testified that the SMPA report is not efficient in terms of time and effort required to use the report in its present structure. The results of the usability evaluation of the SMPA report answered RQ3.

7.3. Research Contribution

This section presents significant contributions claimed by this research to the knowledge base. The research investigated a specific under-studied ITSM problem and tested the validity of a proposed solution in an industry setting. Hence, the research holds significance for both academia and practice. This research uses the DSR knowledge contribution framework (Gregor & Hevner 2013) to position its knowledge contributions. The DSR knowledge contribution framework presents two dimensions based on the existing state of knowledge in both the problem and solution domains. The problem domain is represented by the challenges of ITSM process assessment. The solution domain is represented by the international standards for process assessment and DSS capabilities. This research makes contributions to theory and practice from the research findings and discussions, as well as from a research experience perspective.

The expectations of the research contributions were initially presented in Chapter 1, *sections 1.4.1* and *1.4.2* as part of the justification of the research. From a theoretical perspective, this research expected to develop a method to measure ITSM processes in a transparent and efficient manner. Another expectation from the research was to find a theoretical fit between the challenges of ITSM process assessments and technology requirements to address the challenges in order to develop a solution. In practice, this research was expected to incorporate a readily validated and actionable method that addresses the challenges reported in the ITSM industry regarding high costs and the lack of transparency of existing ITSM process assessments.

Contributions made from a DSR study can be in the form of viable artefacts and at more abstract levels. Using the DSR contribution types presented by Gregor and Hevner (2013), Level 1 and Level 2 contributions are evident in this research. Table 7.1 presents the contribution types in this research. At level 1, situated implementation was constructed as a DSS for the SMPA approach. Likewise a more general artefact in the form of a method (SMPA approach) is proposed as the level 2 contribution.

Table 7.1 DSR Contribution Types (based on Gregor and Hevner 2013)

Contribution Type	**Research artefact**
Level 3. Comprehensive design theory	None
Level 2. Nascent design theory – knowledge as operational principles	SMPA approach
Level 1. Situated implementation of artefact	DSS for the SMPA approach

The DSR knowledge contribution framework has four quadrants according to the maturity of research problem and solution: Invention; Improvement; Exaptation; and Routine Design (Gregor & Hevner 2013). The contribution of this research resides in the Improvement quadrant since this research proposed new solutions for known problems. The goal of this research is to create better solutions in the form of a more usable method to conduct ITSM process assessments as compared to the existing methods. One of the key challenges in this quadrant is to clearly demonstrate that the improved solution builds upon previous knowledge. Chapters 2 to 6 demonstrated how the SMPA approach can be positioned to build design knowledge. Hence, the SMPA approach is a nascent design theory that contributes to a well-known problem where existing theories have shortcomings.

7.3.1. Contribution to Theory and Literature

It is suggested that the SMPA approach is an important contribution as design knowledge towards a "theory for design and action" (Gregor 2006). This research contributes to theory by presenting a literature review of ITSM process assessment that demonstrated the lack of transparency and the need for efficiency in the existing empirical studies and industry practices. This research contributes to the academic literature by addressing the current gap about the drawbacks of ITSM process assessments. The literature review led to the proposal of the SMPA approach as a solution. The SMPA approach clarifies and extends prior guidelines of ITSM process assessment by providing a fine-grained method to assess ITSM processes. In contrast, prior studies typically conducted process assessments using proprietary assessment models and applied human judgement in process capability ratings without a transparent method or DSS support.

The contribution offered in this research includes several abstract artefacts. These artefacts are the overall method description (SMPA approach), the constructs (assessment goals, questions and metrics), the design principles (based on the fit profile and themes emerging from discussions of research questions), and the implicit technological rules (algorithms and pseudo code for DSS implementation). Offering these artefacts at an abstract level means that they can be operationalised in a number of other unstudied contexts, thus greatly increasing the external validity of this research. These artefacts are not yet, however, at the level of a comprehensive design theory.

This research contributes to ITSM process assessment literature by advocating the SMPA approach that clarifies the impact of software mediation to bring transparency and efficiency in the way process assessments are conducted. For example, the process selection method in Phase 1 of the SMPA approach can be viewed as a functional design principle. It extends prior guidelines by providing a fine-grained approach to select critical ITSM processes for improvement. In addition, it clarifies the importance of using two key decision factors: business objectives and service gap perceptions, based on the Balanced Scorecard and SERVQUAL models respectively. Guidelines to take kernel theories, the Balanced Scorecard and SERVQUAL frameworks, and use them to produce a theoretically-grounded artefact are significant contributions presented as a useful design principle in this research.

Another literary contribution of this research is the development of a literature classification model. The parent disciplines of "quality" and "service" were reviewed to develop a literature classification model for ITSM process assessment. The literature classification model (Chapter 2, Figure 2.3) linked the research topic of ITSM process assessment to the wider body of knowledge. The literature classification model is one of the significant outcomes of the literature review to establish a concrete position of ITSM process assessment in the literature. A definition for ITSM process assessment was proposed based on the model. The development of the model demonstrates rigour in the literature review process.

Furthermore, the SMPA approach demonstrates the justification of using Agency theory (Eisenhardt 1989a) and Transaction Cost Economics (Williamson 1981). This research contributes to the existing literature by applying these two grand theories in the context of the ITSM agency relationship. The research artefact may provide a transparent contract in suggesting to the business how service improvements are being carried out by the IT organisation thus reducing information asymmetry. The use of a DSS to operationalise the SMPA approach can potentially reduce transaction costs of conducting ITSM process assessments. Hence the two theories provided a foundation to justify development of the approach and ultimately the significance of the artefact. Likewise, by providing a structured approach to measure process capabilities, this research addresses the literature gap in the CSI literature of ITSM to achieve transparent and efficient measurement of process capability for improvement.

This research presents a goal-oriented measurement structure for ITSM process assessments based on the GQM approach (Van Solingen et al. 2002). Assessment goals were specified for each of the process attribute levels. A number of assessment questions were related to specific assessment goals and the responses to the questions were calibrated with a metric of process knowledge from testimony. The SMPA approach addressed transparency issues in ITSM process assessment by following a goal-oriented measurement of ITSM processes using a standard PAM. Besides the use of the international standard for process assessment, the contributions of the SMPA approach are twofold: transparency and efficiency by using online surveys to allow faster and consistent assessment data collection and analysis; and use of a knowledge base for process improvement recommendations which would otherwise possibly require several experts from different disciplines. The SMPA approach highlights how the GQM approach, which has not been widely utilised in the ITSM discipline previously, can overcome the limitations of existing process assessment approaches.

A significant contributing factor to claim generalisation of the SMPA approach is the use of the international standard for process assessment ISO/IEC 15504 which provides a consistent structure to conduct process assessments in any domain. The assessment model provided by ISO/IEC 15504 consists of a specific process dimension and a generic capability dimension (ISO/IEC 2005a). For any process, the base practice indicators can be reviewed to generate new process performance (CL1) questions. However the questions for higher capability levels (CL2 to CL5) and the overall SMPA approach may remain consistent to be applicable for any ITSM process.

This research uses TTF theory (Zigurs & Buckland 1998) to conceptualise the fit between the task challenges at hand and DSS technology dimensions. This research contributes to the existing literature by operationalising a task-technology fit construct for decision tasks on process assessments using a DSS in the context of ITSM. This research demonstrates to future researchers the value and applicability of a kernel theory to justify the design process, as proposed by Walls, Widmeyer and El Sawy (2004). In terms of theoretical contribution, this research is arguably the first to integrate TTF theory with the DSR method. The application of a fit profile from task challenges and DSS technology requirements in order to develop an artefact as a technology solution is empirically demonstrated in this research. The fit profile provided design principles where an explicit specification of task problems and technology requirements guided the design process in this research. More specifically, the integration of TTF theory in DSR methodology is applied in this research as a novel kernel theory as illustrated in Chapter 3, Figure 3.4.

The SMPA approach was demonstrated at two IT service providers to evaluate the usability of the approach. The use of expected decision quality and expected decision efficiency factors for outcome evaluation has been extended from similar studies in other web-based DSS technologies (e.g. Jarupathirun & Zahedi 2007). This research demonstrates how intensive research methods such as multiple case studies for evaluation of an artefact and its outcome can be combined with an iterative design process as a credible research activity to develop research artefacts that are tested in real-life environment.

Based on the extensive review of literature, it was found that there are no well-established theories to support the method of ITSM process assessment while its application in industry is left for organisations and consultants to decide in an ad-hoc manner. In contrast, the SMPA approach supported by the DSS can provide a reasonable demonstration of reliability and content validity. The SMPA approach also has valuable descriptive and prescriptive utility since it provides design knowledge that is readily actionable. Therefore, the SMPA approach is well suited for further explanatory and predictive research, which can then be used to examine the artefact's predictive utility and statistical validity.

This research makes a further contribution to knowledge on ITSM. Despite being critically important to the success of many organisations, ITSM has received insufficient attention in the empirical literature amidst growing industry adoption (Galup et al. 2007; Ostrom et al. 2010). By developing clearer ways to assess ITSM processes based on the international standards and using a DSS, this research helps clarify unique challenges in process assessment activities and furthers our understanding of a consistent method to overcome such challenges.

Although evaluation plays a major part in DSR, very little guidance and examples have been provided on how one could actually discuss evaluation in DSR. To address this problem, this research presented a simple logic model to discuss artefact outcome evaluation. Reflection on the evaluation of the SMPA report suggests that key insights can be drawn from the logic model that can potentially improve the way DSR evaluation is discussed. This research provides an example how the concepts of a logic model might be useful to discuss DSR evaluation.

Finally, this research makes an important contribution to design science theory by demonstrating a DSR approach to develop a method as a research artefact that is also operationalised as a DSS. The detailed explanation of prior theories, expository examples, and case study evaluations provide an example of how to confront the challenges of presenting design work for a novel approach. This research demonstrates how a DSR methodology can be useful not only for the design of an instantiation (DSS in this research), but also for the design of methods (SMPA approach in this research) as an artefact that provide theoretically-grounded guidelines to both researchers and practitioners. Drawing upon extant DSR methodology (e.g. Gregor & Jones 2007; Hevner et al. 2004; Peffers et al. 2008), the approach is well suited for IS research to balance the dual requirements of rigor and relevance (Benbasat & Zmud 1999; Rosemann & Vessey 2008; Straub & Ang 2011).

7.3.2. Contribution to ITSM Industry and Practice

Academic researchers make valuable contributions to the design and investigation of innovative artefacts but effective transition of these artefacts to industrial use requires their integration into, and evaluation within, the business context. In some cases the innovation required is not so much the design of a new artefact but its adaptation to the pattern of use within the organisation. From a practical standpoint, the SMPA approach has features to collect assessment data, measure process capability and provide process improvement recommendations. This research demonstrated how the SMPA approach was applied in practice by developing a DSS to implement the method at the two case study organisations.

The widely popular ITIL framework and the international standard for ITSM ISO/IEC 20000 are inadequate to provide transparent and efficient guidelines or requirements to assess ITSM processes. A significant benefit of using the SMPA approach is that practitioners can gain a better understanding of the workflow to assess ITSM process capabilities. The implication for practitioners is that the SMPA approach provides a comprehensive set of design knowledge for ITSM process assessments. The artefact helps an organisation avoid wasting scarce resources on elaborate and complex assessment techniques. Similarly, when organisations evaluate new or existing ITSM processes, they can regularly use the SMPA approach to assess how well the capabilities of their processes enable CSI. This research provides necessary insights for ITSM managers and organisations faced with the challenge of risk and uncertainty while implementing ITSM process improvements to maximise return on investment of ITSM projects.

The SMPA approach provides a new opportunity for automation and transparency in the way process assessments are conducted in IT organisations. Beyond the discipline of ITSM, the SMPA approach can potentially be applied to other models or domains where a PAM is available. For example, COBIT has already released an ISO/IEC 15504 compliant PAM for its IT governance processes (ISACA 2013). With the expanding significance and reach of the ISO/IEC 15504 standard and the soon-to-be-published ISO/IEC 330xx series, the SMPA approach is expected to be a useful method for process assessments in any discipline that promotes a compliant assessment model.

In the ITSM community, this research demonstrated a goal-oriented measurement based on the GQM approach for ITSM process assessments. Organisations can use the research artefact as an evidence-based tool to support decisions on process improvements. Process improvement projects can be disruptive in organisations and hence it is important to secure management buy-in early in the project (Hunsberger 2012). The SMPA approach may provide informed choices to assure top management that a structured method is followed to assess the capability of ITSM processes. Furthermore, practitioners could use the process improvement recommendations from the SMPA report to highlight the path to CSI. In other words, the SMPA approach can measure the performance of CSI activities on a regular and consistent basis.

This research has built arguably a world-first automated process assessment tool based on the international standards for ITSM and process assessment. Software tools play a vital role to help organisations achieve productivity and to assure the quality and integrity of the organisation’s processes. Productivity is enhanced by tools that automate processes or minimise the cognitive and physical effort required to undertake a task. Integrity is enhanced by tools that measure process capability without fear or favour, for example during the assessment of ITSM processes using the DSS in the SMPA approach.

The SMPA approach developed as an artefact enables IT service organisations to self-assess the capability of their ITSM processes. Iterations of self-assessments of processes facilitated by the SMPA approach can be an effective and efficient approach for process improvements and ultimately for CSI. Moreover, the models and design knowledge developed in this research forms a base for subsequent research, implementation and evaluation that may contribute to such efforts as the trials for the international standards for ITSM and process assessment. By trialling the international standards in industry, this research confirms that the standards are useful and supports the transition of new standards for effective industry use.

The SMPA approach uses the mean value score and the coefficient of variation metrics to determine process capability score and reliability of the score. The interpretation of the mean value and the coefficient of variation are important tasks for a competent assessor. The SMPA approach can assist the assessors to conduct formal assessments by providing a dataset of testimony evidence for assessments.

The SMPA approach has utility to conduct self-assessments specifically for small and mid-size organisations that may not be able to afford ITSM consultants or do not have sufficient budget to conduct comprehensive process assessments. One of the significant milestones of this research is its commercialisation. The industry partner that supported this research project (AP) has already incorporated the research artefact into a range of assessment services offered to their clients. Moreover, AP is actively promoting this research. AP has showcased the benefits of its involvement in this research with a corporate video promotion featuring its partnership with USQ in this research. The video can be accessed from AP's website through this link: http://www.assessment-portal.com/USQPartnership.aspx. AP is also implementing the lessons learnt from this research into practice for their assessment services.

The SMPA approach provides a valid contribution in the area of adaptive learning for IT organisations. The capacity to continuously improve processes is a useful insight towards learning and adapting from past challenges and deficiencies (Murray & Chapman 2003). While many organisations claim to have used the ITIL framework, the implementation of the ITIL framework is challenging and improvements from using the ITIL framework are difficult to measure (Cannon 2011). The concept of adaptive learning can be applied in the ITSM community for business training in order to progressively implement the ITIL framework while following the path of CSI. In this scenario, the SMPA approach can be used as a learning and training tool in order to convey the necessary process knowledge to all concerned process stakeholders and thereby contribute towards CSI.

Furthermore, a practitioner could use the assessment results from the SMPA approach to benchmark the firm or business unit against other firms or business units. For example, the overall process profile of ITSM processes at CITEC was better than that at TRC ICT, which highlights a greater problem with the ITSM process capabilities for TRC ICT. The measurement phase of the SMPA approach (Phase 3) could be used to identify the business unit(s) that had the highest or lowest process profile, while the improvement phase (Phase 4) could identify observations and actions for business unit(s) to consider in order to improve their IT services.

The case studies also revealed additional findings that have implications for practice. For example, when senior IT management is faced with the challenges of improving processes, they tend to struggle with decision-making on process improvements due to the lack of specific guidelines – a typical business-agency problem. The SMPA approach presented a solution to this challenge by facilitating the generation of process capability scores in a transparent and efficient manner so that processes can be improved.

The Australian Government has adopted the recommendations of the Gershon report (2008) which requires all agencies to assess their current ICT infrastructure capability, identify a target capability level, and develop a capability improvement plan. The report urged the implementation of a common methodology for assessing agency ICT capability based on self-assessment and periodic independent audits. Gershon (2008) also reported that ITIL was widely used in government agencies and endorsed by private-sector firms. The SMPA approach developed in this research can be valuable to government agencies to provide a common methodology for self-assessments. Private-sector organisations may similarly benefit from the use of the method.

Moreover, cases CITEC and TRC ICT demonstrated how two business units in different organisations may exhibit very different process profile patterns, even though both organisations advocated compliance with the ITIL framework. It was observed that the overall organisation climate at CITEC was unstable during evaluation. Evaluation participants at CITEC were concerned about their job security and ongoing organisational changes. At TRC ICT, participants felt that while they have obtained some formal ITIL training, the ITIL framework has not been fully implemented in their processes and working culture. This shows how important it is for organisations to see the impact of the SMPA approach on their organisation and themselves. This situation highlights the role of organisation and individuals in technology implementation as discussed in the structurational model of using technology (Orlikowski 2008). Since these factors were outside the scope of the project, it is a limitation of this study and an important topic worthy of further study. A more elaborate discussion of the limitations of this research is presented next.

7.4. Limitations of the Research

The scope of this research is delimited by the philosophical underpinning, theoretical support, research design and the selected research methods as discussed in Chapter 1, *section 1.7*. Furthermore, the limits defined in the literature review protocol (Chapter 2, Table 2.1) resulted in the exclusion of literature that did not meet the predefined criteria. It is possible that relevant research is available in literature from non-English academic studies, business process improvement discipline, software process improvement discipline, and industry literature related to specific ITSM processes or applications that are excluded in this research.

The SMPA approach requires respondents to answer assessment questions based on the process indicators from the ISO/IEC 15504 PAM directly (ISO/IEC 2012b). Some respondents might have unrealistic perceptions about their process activities, especially if they do not have sufficient experience. A more lengthy and rigorous ITSM process assessment approach would involve the review of process input and output documents (work products) as instructed in the ISO/ IEC 15504 standard (ISO/IEC 2004a). This may provide more valid and reliable data for analysis and for process improvement recommendations.

The case study in this research included certain limitations. First, regarding internal validity, evaluation data were collected using qualitative research methods. Quantitative methods, such as a survey on the expectations from ITSM process assessments, could have provided a broader view on the topic. However, the qualitative case study method is well-suited to study process-related challenges in an organisational context. Additionally, a rich set of data sources was used to build a detailed view of the IT organisation and its process culture. Nevertheless, a recognised limitation of the qualitative case study approach is the lack of ability to generalise the findings. Despite the innovative prospects of this research, it is necessary to conduct comprehensive evaluation and consider quantitative analysis of the results of ITSM process assessment for further improvement of the artefact. In this research, with only a qualitative focus, there are no claims that can be made on how well the research results could be generalised to different organisations and processes. Besides the limitations of a case study approach, there are also limitations in the data gathered since the research questions are seeking only qualitative answers regarding the development and evaluation of the SMPA approach. There is greater attention to sample purposely selected cases for their potential to yield insights from rich information sources to answer the research questions in this research.

Second, concerning case selection and external validity, the two case study organisations, CITEC and TRC ICT, were partners in a multi-party agreement in this research project. Thus, convenience sampling, a generally accepted way to recruit case organisations, was used as a sampling strategy. The two case study organisations were required to be in close proximity in order to conduct the iterative design process and evaluation studies for this research. Future research using parametric sampling and more powerful statistical analysis could be conducted to further quantify the design knowledge identified in this research.

Third, this research reviewed the process capability in two case study organisations. A larger number of cases and comparison between them based on diverse evaluation factors would have increased the quality of the case study research. Despite the application of academic rigour and industry experience, it is uncertain how well the SMPA approach performs across different organisations since the potential application of the SMPA report on different organisational contexts has not been studied. Moreover, the first phase of the SMPA approach (Phase 1 preparation) was evaluated in one case study organisation only (TRC ICT). The IT service managers in the single case study provided positive feedback and accepted the recommendations from the DSS. However, how well this artefact contributes to actual service improvements is beyond the scope of evaluation.

Another limitation of this research is the ability of the DSS to assess only four ITSM processes. Even though the SMPA approach can be applied to any number of ITSM processes, the temporal constraints in this research project limited the number of processes in the DSS because of the time required to compose the survey questions and ITIL knowledge items for each process. There are 26 processes defined in the ITIL framework and 13 processes along with a number of service management requirements in ISO/IEC 20000. Therefore, the DSS currently covers only a subset of ITSM processes for assessment. All ITSM processes were considered in phase 1 of the SMPA approach. However the survey questions and knowledge base for the other phases are only populated with the four ITSM processes that were selected as important by the case study organisations.

Even though there were several "build-evaluate" DSR cycles during the iterative design process to develop the SMPA approach, only a single development cycle was effected. The feedback received from the summative evaluations and lessons learnt from the case study trials of the SMPA approach were not incorporated for another review and modification of the SMPA approach and the DSS. Findings from the summative evaluations were reported back to the industry partner AP for subsequent updates. Some of the significant feedbacks received during artefact evaluation, such as the complaint that the DSS did not generate an executive summary in the SMPA report, could be addressed in future development cycles. However further development cycles were outside the scope of this research.

Since this research focused on the definition of the problem and construction of an artefact in detail, the evaluation aspect of the research is limited in scope in comparison to studies that use existing artefacts for evaluation (Gregor & Hevner 2013). As presented in the structurational model of technology implementation (Orlikowski 2008), organisational and individual factors have a significant impact on technology implementation. Evaluation in this research ignored these factors and focused on the specific technology factors alone. Further in-depth case evaluations could be conducted in order to study the impacts of the factors other than technological, but this research ran the risk and challenge of expanding the details of the case studies compounding on an already complex study.

The DSRM approach (Peffers et al. 2008) followed in this research required involvement of third parties in the iterative design process, evaluation and communication steps. The third parties included the experts of the international standards and ITSM industry practitioners involved in the design and testing of the SMPA approach; case study participants at CITEC and TRC ICT involved in the evaluation stage; and the reviewers and editors of the ITSM industry and academic journal articles and conference papers written during this research project. The priorities and worldviews of the third parties are possibly different to those of the research team members and these are beyond the control of this research. To fully evaluate the SMPA approach developed in this research, more time and resources would be required than the two case study organisations were willing to make available, given the organisation climate at the time of this research.

The SMPA approach is not a fully standards-compliant method to determine process capability, however it is believed to provide a reliable indication of the process capability levels. A standard assessment is generally conducted by taking multiple factors into consideration: manifold objective evidences, observations, document reviews, stakeholder testimonies and expert judgment. The definition of the SMPA approach provided in Chapter 1, *section 1.2* as a standards-based approach does not imply that the SMPA approach is fully compliant with the ISO/IEC 15504 standard. Consequently it cannot be claimed that the SMPA approach can represent or replace a formal process assessment such as an official CMMI appraisal or ISO/IEC 15504 certified assessment. The SMPA approach was developed with an intention to automate some parts of a process assessment based on ISO/IEC 15504-2 to enable organisations to self-assess or assist the assessment team by providing one form of objective evidence for formal assessments.

Moreover, it cannot be claimed the SMPA approach is the best ITSM process assessment method to address transparency and efficiency concerns for all organisations. As the discussion of the artefact outcome evaluation revealed, the best approach may be a hybrid of manual assessments and the SMPA approach. Moreover, the process selection method in the SMPA approach proposed the application of business drivers and service gap perceptions to select the most important processes to improve. Other variables such as risks, external audit, compliance and cost/benefit analysis could also have been considered to identify critical processes. Nevertheless the major research objective is to demonstrate how the SMPA approach can facilitate a structured method in ITSM process assessment. This research has met its major objectives.

7.5. Directions for Future Research

A significant DSR program includes multiple researchers working over many years with several intermediate research results during its evolution (Gregor & Hevner 2013). The construction of the research artefact and its description in terms of design principles and technological rules are first steps in the process of developing more comprehensive bodies of knowledge or design theories. This research proposed a set of design artefacts that is an initial step in the development of a process assessment theory. A number of future research directions can therefore be proposed from this research.

In order to obtain a richer view of integration of the SMPA approach, the aim for future research should be to apply the artefact in other organisations and with more processes in order to confirm and generalise the applicability and effectiveness of the SMPA approach. Future research should explore feedback cycles from several iterations of evaluation. This should lead to a robust method defined as a design theory (Gregor & Jones 2007) or a process theory (Markus & Robey 1988) capable of guiding decisions for process improvement in any domain beyond ITSM. As a direction for future research, this research can continue to pursue “emergent” research designs to explicate new design knowledge towards a quest to develop design theories.

This research can act, for example, as a pilot case study for further studies. During this research several targets for further research were identified. The scope of this DSR research was principally to evaluate the short-term outcomes – the first-level evaluation outcome. However, deeper analysis of evaluation findings and further evaluation cycles may uncover interesting intermediate and long-term impacts of the SMPA approach that have lasting implications for research and practice. This research did not act upon the results of the evaluation for further refinement of the SMPA approach. A number of design considerations that emerged from the evaluations were submitted to the industry partner AP for subsequent changes to the SMPA approach. Future research should build on the iterative design process to observe the impact of “build-evaluate” cycles on the usability of the SMPA approach.

This research focused on perceptual outcome evaluation factors (expected decision quality and expected decision efficiency) to examine the impact of the SMPA approach on decision-making for process improvement. A number of prominent studies have supported the relationship between TTF theory and perceived decision quality (e.g.

Todd & Benbasat 1999; Zigurs et al. 1999). However actual decision outcomes from the SMPA approach and factors such as the repeated use of the SMPA approach and the impact of the SMPA approach on process improvement and CSI are not empirically evaluated. These constructs require longitudinal data and involve complex causal relationships that are beyond the scope of this research. A direction for future research would be to undertake empirical studies of these constructs for the proposed SMPA approach.

ITSM processes were well suited for testing the usability of the SMPA approach because there are several well-defined processes designed to measure improvement in ITSM (ISO/IEC 2010). The assessment approach was developed and evaluated for four ITSM processes based on the ISO/IEC 20000 standard. However, using the groundwork covered in this research, the approach can be easily extended to include other ITSM processes and even extend the domain of process assessments beyond ITSM to the area of IT governance, e.g. COBIT assessments, or the area of IT project management, e.g. the assessment of the Project Management Body of Knowledge (PMBOK) guidelines or the PRojects IN Controlled Environments (PRINCE2) framework. It is expected that since most other types of management systems have adopted the process approach principle, it is possible to assess processes for improvement in those domains based on the SMPA approach by configuring the DSS with a specific PRM and PAM as required. For example, COBIT is a popular framework for the governance of enterprise IT that has 37 defined enabling processes (ISACA 2012). A PAM compliant with ISO/IEC 15504 is available for COBIT (ISACA 2013). Using the PAM, an online survey can be developed for the assessment of COBIT processes. Thus, future research could consider the use of the SMPA approach in other disciplines.

There is great diversity in the characteristics and roles of IT services besides ITSM process capability, such as IT service quality, IT systems quality, customer satisfaction, service value and service behaviour (Lepmets et al. 2012). The SMPA approach can assess these metrics by selecting appropriate frameworks for the survey engine and knowledge base of the SMPA approach. For instance, to measure customer satisfaction of IT services, the SMPA approach could be applied where the survey is based on measuring customer satisfaction according to the extensive survey guidelines proposed by Hayes (1998). In accordance, the knowledge base could possibly be based on the SERVQUAL model to report customer-supplier gaps in the measurement of IT service quality (Kang & Bradley 2002).

It is obvious that the actual performance of process improvement projects is dependent on a number of external organisational factors such as top management commitment, budget and priorities for undertaking improvement activities, effectiveness of the improvement plans, regulatory and compliance issues, requirements for certification, risk management and so forth. These factors have not been considered in the evaluation of the SMPA approach. Nevertheless, a foundation is laid for the application of DSS in process assessments and it is certain that future evaluations and improvements to the SMPA approach can make further contributions in this area. A more lengthy and rigorous method would involve reviewing other decision factors that the organisations might consider while assessing processes to improve.

The ISO/IEC 15504 process assessment standard used in this research provides a useful assessment method to determine ITSM process capabilities for comparison with other business units or other organisations. Future work can involve comparison of process capabilities between organisations in benchmarking studies and to clarify the relationship between assessment and outcomes such as service improvement, customer satisfaction or the CSI service lifecycle. The conditions under which the ITSM process capabilities are associated with improved service delivery and customer satisfaction could then be examined, which in turn would lead to stronger explanatory and predictive theories.

Another consideration for future research is to continue to investigate how the proposed logic model could be applied in other DSR evaluations and whether this can promote transparency and clarity in DSR evaluation work. Future DSR projects can catalogue their evaluation findings to illustrate how insights stemming from artefact evaluation can be discussed using a logic model as demonstrated in this research. The logic model has been included as part of the RQ3 discussions to allow for potential replication, and confirmation of findings. Future research can use the proposed model as a template to discuss evaluation results. This represents a contribution to the growing body of guidelines for DSR research. Further research is needed to refine the logic model to better discuss DSR evaluation methods.

Further tests of the practical utility of the SMPA approach could be undertaken by examining the acceptance of the method in the industry marketplace. As defined by Kasanen, Lukka and Siitonen (1993), a weak market test examines whether any managers have decided to use the approach in actual decision-making. A semi-strong market test examines whether the approach is widely adopted by organisations. A strong market test examines whether organisations that use the SMPA approach outperform others. The SMPA approach has already passed the weak market test through the evaluation conducted in this research. This is because the SMPA approach has already been used by ITSM process managers to gain a better understanding of their organisation's ITSM process capabilities. In the view of this researcher, this research is sufficiently robust and flexible so that future studies can continue to evaluate, refine, and disseminate the SMPA approach for its wider adoption in industry.

Reflecting on the experience in this research, it has been found that the DSR methodology is valuable to propose novel methods that require intensive pilot testing due to immature or non-direct prior theories. The DSR methodology, with its careful attention to evaluation of artefacts, encourages researchers to more clearly define the research problem space and solution space (Venable 2006) before confirmatory studies proceed. Finally, future research should consider applications of kernel theories, such as those used in this research, to confirm or refine propositions to further extend design knowledge for the development of design theories in IS research.

7.6. Chapter Summary

This research achieved synergy between theory and practice by drawing on academic and practitioner literature and collaborating with academia and industry for the design, development and evaluation of the SMPA approach.

Just as the CMMI made it possible for organisations to contract software services from software providers all over the world with confidence, the expected utility of the SMPA approach is to facilitate, and eventually "commoditise" IT service capabilities to forge successful IT-business partnerships. The concept of commoditisation

(Davenport 2005) applies well as the ultimate value of the SMPA approach for business-IT alignment. While this research concentrates on a case of assessment of ITSM processes, the use of a generic international standard for process assessment ISO/IEC 15504 and DSS functionalities provide inspiration to inject transparency and efficiency in the way process assessments are conducted. However it must be clear that the SMPA approach provides a useful framework for process improvement but does not dictate or monitor how an organisation should actually improve.

Future research involving the artefact design and/or longitudinal evaluation studies would broaden the applicability and representativeness of this research. As discussed in the previous section, further studies may involve extending the case evaluations for actual outcomes, applying the SMPA approach in different organisational contexts and perhaps even in different countries and re-designing the SMPA approach to assess process metrics in other disciplines beyond ITSM.

Reflecting on this researcher's experience, it was found the DSR methodology is valuable to develop an ITSM process assessment method that requires intensive pilot testing due to immature or conflicting prior theory. At the conclusion of this research, it can be stated that the research has met its objectives. Moreover, due to the relative newness of the theory base in the ITSM discipline, this research applied theories and research instruments developed in other studies to solve research problems in completely different contexts. The coupling of carefully designed research artefacts with rigorous evaluation has great potential to produce stronger IS design theories that may be valuable to both researchers and practitioners within and beyond the IS discipline.

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List of Appendices

Appendix A. SERVQUAL model

A model of service quality called SERVQUAL was developed by Parasuraman, Zeithaml and Berry (1985) that demonstrates a set of service gaps regarding perceptions of service quality and the tasks associated with service delivery to customers. Reducing the gaps can assist service providers to offer services that customers would perceive as being of high quality. The figure below illustrates the SERV-QUAL model and the five gaps in service perceptions proposed by the model. The SERVQUAL model has been proven to work well to measure the functional quality attributes that include service processes (Kang & James 2004). The SERVQUAL model presents service perception gaps that are used in this research in order to develop a process selection method for ITSM process assessments.

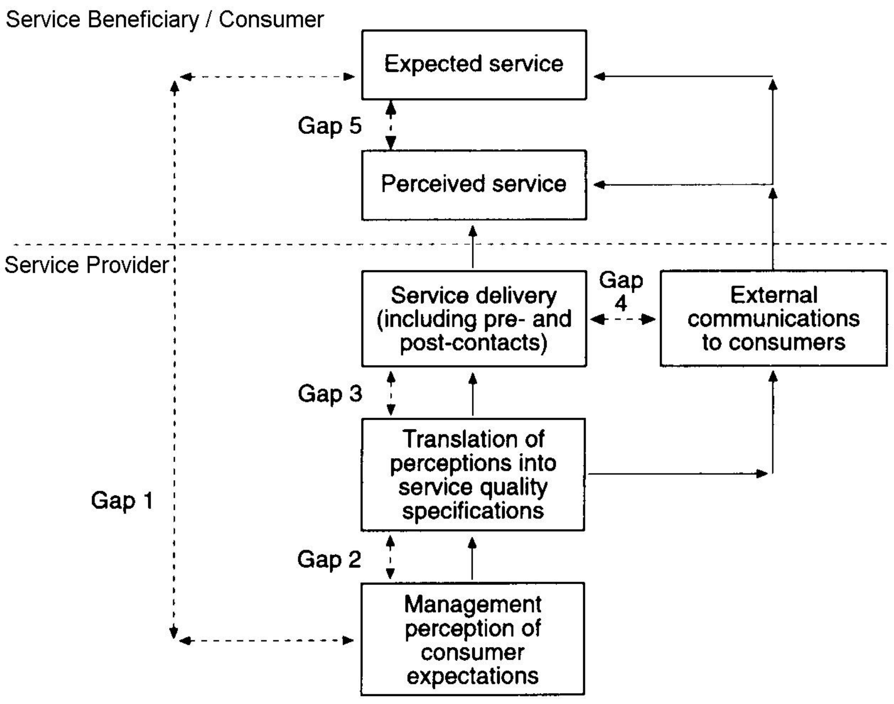

Figure A.1 The SERVQUAL Model

Appendix B. Technical specification of the DSS platform

The DSS platform for the SMPA approach is developed based on the Microsoft Azure cloud technology for assessment facilitation along with a web-based interface for online surveys. The DSS technology infrastructure and application logic was already provided in the platform supplied by the research partner. This research developed a new data model that needed to integrate with the existing DSS platform to implement the SMPA approach.

A data model based on the Unified Modelling Language (UML) notation designed for the DSS of the SMPA approach is presented in Figure B.1.

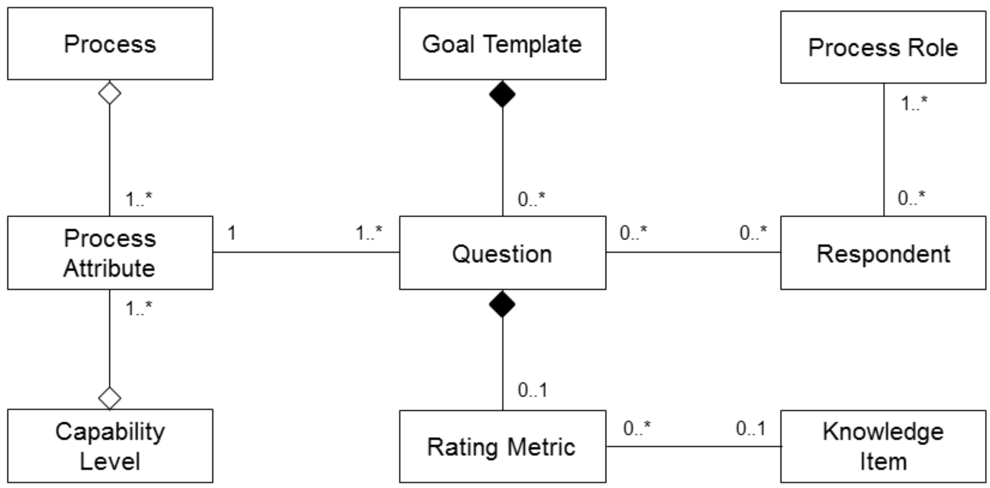

Figure B.1 Data Model of the DSS to Facilitate the SMPA Approach

There are four major artefact components developed in this research: survey questions; process role allocation to question; process measurement logic; and the process improvement knowledge items. These components are stored as data entities in the DSS data model presented in Figure B.1.

Regarding the software platform, the programming language ASP.NET that runs on the Microsoft .NET technology was used to develop the DSS platform. Data for the DSS platform is hosted in the cloud on Microsoft SQL Server database technology. The programming team of the research industry partner was involved in the technical implementation of the DSS.

Appendix C.1 Ethics approval letter

University of Southern Queensland

USQ AUSTRALIA

TOOWOOMBA QUEENSLAND 4350 CRICOS: QLD 00244B NSW 02225M

AUSTRALIA

TELEPHONE +61 7 4631 2300

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OFFICE OF RESEARCH AND HIGHER DEGREES
Ethics Committee Support Officer
PHONE (07) 4631 2690 | FAX (07) 4631 1995
EMAIL ethics@usq.edu.au

Friday, 22 June 2012

Anup Shrestha
Email: w0066847@umail.usq.edu.au

CC: Aileen Cater-Steel (supervisor)

Dear Anup

The Chair of the USQ Fast Track Human Research Ethics Committee (FTHREC) recently reviewed your responses to the FTHREC's conditions placed upon the ethical approval for the below project. Your proposal now meets the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* and full ethics approval has been granted.

Project Title	Software-mediated process assessment in IT service management: development and evaluation of standards-based tools to facilitate continual improvement
Approval no.	H12REA130
Expiry date	01.02.2015
FTHREC Decision	**Approved**

The standard conditions of this approval are:

(a) conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal required by the HREC
(b) advise (email: ethics@usq.edu.au) immediately of any complaints or other issues in relation to the project which may warrant review of the ethical approval of the project
(c) make submission for approval of amendments to the approved project before implementing such changes
(d) provide a 'progress report' for every year of approval
(e) provide a 'final report' when the project is complete
(f) advise in writing if the project has been discontinued.

For (c) to (e) forms are available on the USQ ethics website: http://www.usq.edu.au/research/ethicsbio/human

Please note that failure to comply with the conditions of approval and the *National Statement (2007)* may result in withdrawal of approval for the project.

You may now commence your project. I wish you all the best for the conduct of the project.

Melissa McKain
Ethics Committee Support Officer
Office of Research and Higher Degrees

Toowoomba • Springfield • Fraser Coast usq.edu.au

Appendix C.2 Participant information sheet

University of Southern Queensland

USQ AUSTRALIA

The University of Southern Queensland

Interview Participant Information Sheet

HREC Approval Number: H12REA130

Full Project Title: Software-mediated process assessment in IT service management (ITSM)

Principal Researcher: Assoc. Prof. Aileen Cater-Steel

Student Researcher: Mr. Anup Shrestha

Other Researcher(s): Dr. Wui-Gee Tan; Assoc. Prof. Terry Rout (Griffith University); Prof. Mark Toleman

I would like to invite you to take part in this research project which has two key objectives:

a) To develop a standards-based process assessment tool to improve IT service management processes; and,
b) To evaluate the effectiveness of the tool by implementing it in two large public sector organisations and validating results against manual process assessment methods.

1. <u>Procedures</u>

Participation in this project will involve being interviewed by the principal researcher and the student researcher about:

(a) How was your experience regarding the utility of the assessment tool?; and,
(b) How do you perceive the quality and efficiency of decisions made from the use of the tool in comparison with manual process assessment methods?

Other important information and procedures about your participation in this research project:

- You will be answering interview questions based on your process role (process performer, process manager or other process stakeholders) for the ITSM process being assessed.

- The interview will be of approximately 60-90 minutes in duration. The audio of the interview will be recorded. After the interview you will be sent a transcript of the interview so that you can verify the accuracy of its contents and change/ add to your responses.

- The audio recording of the interview and subsequent transcript will be kept confidential. Data obtained from the interviews will be de-identified before it is presented so that your responses cannot be personally identified. Both you and the researcher will sign a confidentiality protocol before the interviews are commenced.

- Please note however, that although your responses will be confidential and your data de-identified before it is presented, you must not disclose information during the interviews that is confidential, or subject to legal professional privilege. You also must not disclose information that might amount to a breach of anti-discrimination legislation, or of the rules and principles of professional conduct. If unsure, you may wish to seek independent legal advice or guidance from the Queensland Law Society Ethics Centre.

- It is hoped that this research will benefit participants by giving their organisation an international standard-based assessment of critical ITSM processes and recommendations for process improvement.

1

It is further hoped that this research, which explores use of a decision support tool in process assessment activities, will also be of benefit to the wider community as a contribution to the existing literature about ITSM continual service improvement, international standards community, and ITSM process assessment in particular. It is entirely at your own discretion to follow recommendations provided by the tool in order to improve your ITSM process capabilities.

- The research has been approved, and will be monitored by, the University of Southern Queensland's Human Research Ethics Committee. If you have any questions or concerns about the research at any time, you can raise them with the Ethics Officer using the contact details set out below.

2. Voluntary Participation

Participation is entirely voluntary. **If you do not wish to take part you are not obliged to.** If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. Any information already obtained from you will be destroyed, whilst it remains in identifiable form. Once the data has been de-identified, however, then it will not be possible to withdraw the data.

To minimise any risk to you, you will be sent the transcript of the interview once it has been completed, and given the opportunity to verify, clarify and update it.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your relationship you may have with your employer or the University of Southern Queensland.

Please notify the researcher if you decide to withdraw from this project at any stage.

Should you have any queries regarding the progress or conduct of this research, you can contact the principal researcher:

Assoc. Prof. Aileen Cater-Steel
Associate Dean (Research & Research Training)
Faculty of Business, Education, Law & Arts
University of Southern Queensland, Toowoomba QLD 4350
contact: 07 4631 1276 email: aileen.cater-steel@usq.edu.au
After Hours: c/- Anup Shrestha (Student Researcher): 0413 736 974

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer
Office of Research and Higher Degrees
University of Southern Queensland
West Street, Toowoomba 4350
Ph: +61 7 4631 2690
Email: ***ethics@usq.edu.au***

2

Appendix C.3 Consent form

University of Southern Queensland

AUSTRALIA

The University of Southern Queensland

Consent Form for Participant

HREC Approval Number: H12REA130

TO: Participant

Full Project Title: Software-mediated process assessment in IT service management (ITSM)

Principal Researcher: Assoc. Prof. Aileen Cater-Steel

Student Researcher: Mr. Anup Shrestha

Other Researcher(s): Dr. Wui-Gee Tan; Assoc. Prof. Terry Rout (Griffith University); Prof. Mark Toleman

- ☐ I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.
- ☐ I understand the purpose of the research project and my involvement in it.
- ☐ I understand that I may withdraw from the research project at any stage and that this will not affect my status now or in the future.
- ☐ I confirm that I am over 18 years of age.
- ☐ I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential.
- ☐ I understand that I must not disclose information during the project that is confidential, subject to legal professional privilege, or which might amount to a breach of applicable anti-discrimination legislation or rules or principles of legal professional conduct.
- ☐ I understand that I will be audio taped during the study and that the audio recording will be transcribed and sent to me following the interview for verification and clarification purposes. I understand that the audio recording will be downloaded from the recording device for back-up purposes. I understand that hardcopy documentation related to me will be stored in a locked filing cabinet, and data in electronic form will be stored on a password-protected computer and computer server (and on a USB stick for back-up purposes). I understand that the back-up USB and audio recording device will also be stored in a locked filing cabinet when not in use.

Name of participant..

Signed.. **Date**..

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer
Office of Research and Higher Degrees
University of Southern Queensland
West Street, Toowoomba 4350
Ph: +61 7 4631 2690
Email: ***ethics@usq.edu.au***

Appendix D.1 Pre-Assessment Planning Form Template

Form Field	**Possible Options**
ORGANISATION UNIT PROFILE	
Organisation Unit to be assessed	
Industry sector	Banking & Finance | Business Services | Public Services | Manufacturing | Retail | Technology | Others
Approximate number of staff	
IT service provider profile	Internal Service Provider | External Service Provider | Both Internal and External
Geographic spread of service provision	Global | Multi-national | National | Regional | Single site
Focus on the current business cycle	
Approximate annual budget	
Funding source	Cost Centre | Profit Centre | Recovery Centre
Organisational structure	Functional | Customer | Regional | Service | Process
PROCESS ASSESSMENT GOALS	
Assessment sponsor	
Assessment facilitator	
Purpose of this assessment	
Assessment type	Baseline | Checkpoint
Level of support for this assessment	C-level (Board) | Executive management | Senior management | Line management | Supervisory
key drivers of this assessment	
PROCESS ASSESSMENT SCOPE	
Maximum capability level to assess	CL1 | CL2 | CL3 | CL4 | CL5
Processes to assess	Choose from a list of 12 ISO/IEC 20000 processes

Appendix D.2 Survey participant information sheet template

SMPA - ITSM Process Assessment - Survey Participants					
	Name	**Work Email**	**Contact Number**	**Role**	**Available for Evaluation Interview?**
		(Survey link will be emailed)		*(PT or FT?)*	*(Y or N?)*
Process: <PROCESS NAME>					
Process Managers *(managing process activities)*					
Process Performers *(performing process activities)*					
External Process Stakeholders *(interacting or being affected by the process but not directly involved with this process. NOTE: performers and managers of the interfacing processes could be the external process stakeholders)*					

Appendix D.3 ITSM Process-Business Driver Alignment Matrix

Process \ Business Driver	6.1 SLM	6.3 SCAM	6.4 BAS	6.5 CaM	6.6 ISM	7.1 BRM	7.2 SM	8.1 ISRM	8.2 PM	9.1 CoM	9.2 ChM	9.3 RDM
Internal Business Process												
Service-oriented culture	3	3	3	4	3	3	3	4	3	3	3	4
ITSM process excellence	1	3	2	3	1	3	2	3	4	3	3	4
Efficiency of ITSM provision	2	3	4	2	1	2	2	1	1	1	2	1
Security in ITSM processes	3	3	4	2	1	3	1	1	1	1	3	1
Meeting Service Level Agreements	4	4	1	3	1	3	2	3	3	1	3	3
Financial												
Business value of ITSM costs	3	3	4	1	1	2	2	1	1	3	4	3
Ability to control ITSM costs	3	2	4	3	1	3	2	1	1	1	1	2
Return on investment of ITSM infrastructure	2	2	3	2	2	2	2	1	2	3	4	1
Economy of ITSM provision	3	2	4	2	2	2	4	2	3	1	2	3
Understanding ITSM costs to the business	3	2	4	3	2	3	3	2	2	3	3	1
Innovation and Growth												
Harnessing emerging ITSM technologies	2	2	1	1	2	1	2	3	2	3	4	3
ITSM adaptability to business demands	4	1	1	2	1	3	1	4	1	1	3	3
Business productivity in terms of ITSM costs	3	3	2	1	2	1	3	3	3	4	4	3
ITSM capability improvement	4	3	2	4	1	3	2	4	1	1	3	4
ITSM staff management effectiveness	2	1	1	2	1	1	1	3	1	1	4	2
Customer (Internal)												
Value for money of IT services	3	3	3	1	2	3	1	1	1	1	3	1
Responsiveness in IT service support	2	1	2	1	2	2	3	3	3	3	4	3
Transparent Communication	4	1	1	3	1	4	1	4	3	3	2	4
Internal Customer satisfaction of IT services	4	3	2	3	2	4	2	4	3	1	3	3
Availability & Reliability of IT services	3	3	3	1	2	3	1	2	1	1	3	3
Customer (External)												
Customer as a partner in IT services	4	4	1	3	4	4	2	1	1	1	1	1
Quality in IT services	3	3	1	2	3	3	1	3	3	1	2	3
External Customer Satisfaction of IT services	3	2	1	1	2	2	2	3	3	1	2	3
Service level performance of IT services	4	4	1	2	3	4	2	3	1	1	2	3
Capacity of IT service provision	3	3	1	1	2	2	3	1	1	1	3	2

Appendix D.4 Online survey email format

From: donotreply@myassessmentportal.com [mailto:donotreply@myassessmentportal.com]
Sent: Friday, 11 October 2013 10:14 AM
To: <SURVEY PARTICIPANT>
Subject: Software-mediated ITSM Process Assessments for <ORGANISATION UNIT TO BE ASSESSED>

This email was generated automatically please DO NOT REPLY.

Dear <SURVEY PARTICIPANT FIRST NAME>,

Further to your recent discussions with <ASSESSMENT FACILITATOR> you have been selected to participate in a research project to evaluate a software-mediated process assessment (SMPA) tool for IT service management (ITSM) processes. This research has been supported by the assessment sponsor <ASSESSMENT SPONSOR>. This is a collaborative research project supported by six institutions: Australian Research Council (ARC), University of Southern Queensland (USQ), Griffith University, Assessment Portal, CITEC and Toowoomba Regional Council.

Participation involves completing online survey for ITSM process assessments. The questions are based on the international standard of ITSM: ISO/IEC 20000 and the international standard of process assessment: ISO/IEC 15504. This survey is NOT an assessment of your individual performance but a general process assessment in a research setting.
We are aiming for the surveys to be completed by close of business on <SURVEY DEADLINE>.

Additional information will be available when you access your assessment survey(s) by clicking on the following link: **Survey Portal** **<LINK>**

For each assessment question in the survey, please select one option that best corresponds to your answer. Questions are sequenced based on the capability levels defined in the ISO/IEC 15504 standard. At the completion of each level, the survey will inform your progress and process assessment objectives for the next level questions. Every response is saved instantly therefore you can come back to this survey and start from where you left anytime. Please note if you go BACK in any of the responses it deletes the current response. You are also encouraged to provide any specific comments that you may have to explain or justify your answer option to any question.

Answer options	Selecting this option means…
Yes, always	You are certain that the activity is usually performed.
Yes, most of the time	You are certain that the activity is performed in the majority of cases.
Yes but only sometimes	You know that the activity is performed but not frequently.
No, never	You are certain that the activity is not or rarely performed.
Don't know or unable to comment	You do not have enough information to answer the question.
Don't understand the question	You do not think the question is clear or relevant in your context.

1

This research project has been approved by USQ's Human Research Ethics Committee (Approval No. H12REA130). If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Officer on the following details:

Human Research Ethics Committee
University of Southern Queensland
Ph: +61 7 4631 2690, Email: ethics@usq.edu.au

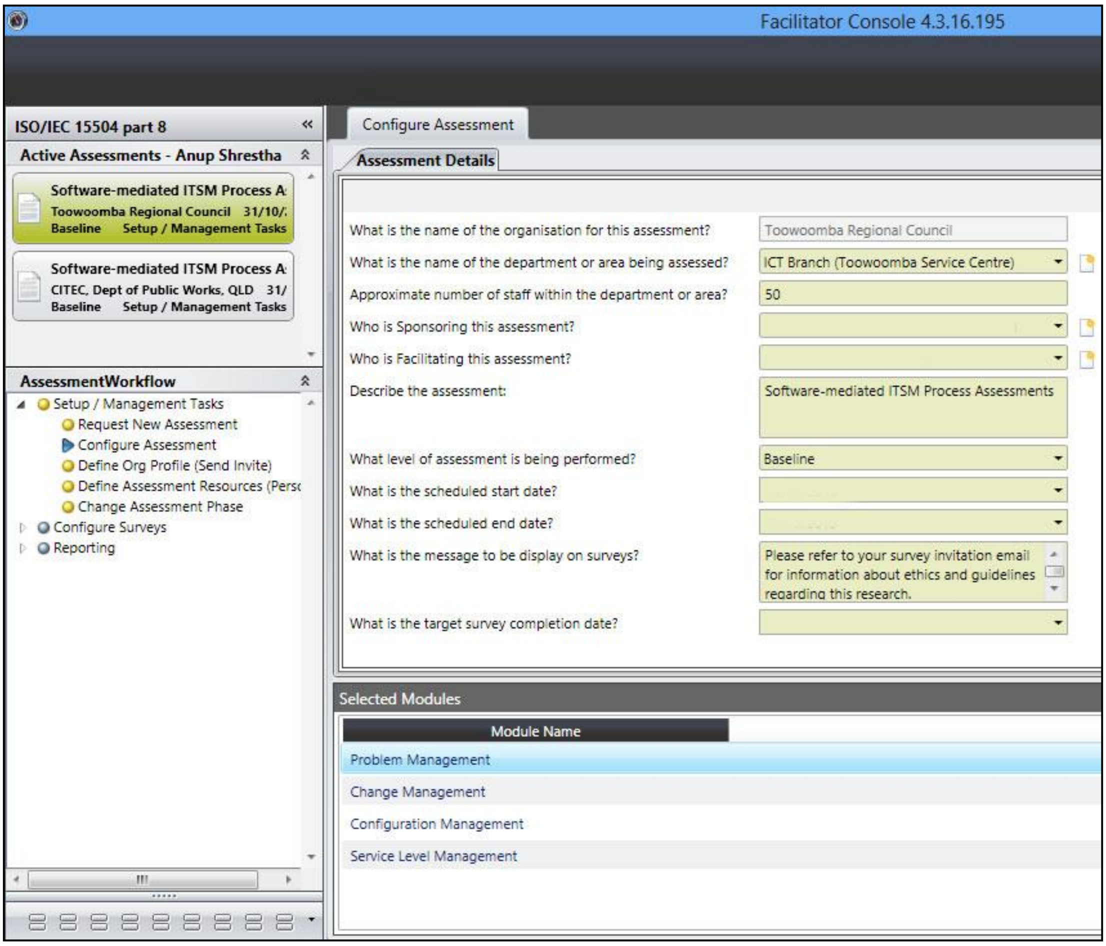
All information will be kept confidential. Your response will be coded and no information will be reported that will identify you as the source. Your completion and submission of this survey implies informed consent. Your participation is voluntary. If at any time during the study you wish to withdraw your participation, you are free to do so without consequence and without need to provide a reason. Upon completion of the study both yourself, as a participant, and the university will have access to a summary of the study's findings.

If you have any questions prior to your participation or at any time throughout the study, please do not hesitate to contact your assessment facilitator <ASSESSMENT FACILITATOR> on <ASSESSMENT FACILITATOR EMAIL>.

Kind Regards,
Anup Shrestha
PhD Candidate
anup.shrestha@usq.edu.au
USQ Australian Research Council Linkage Project on ITSM Process Assessment

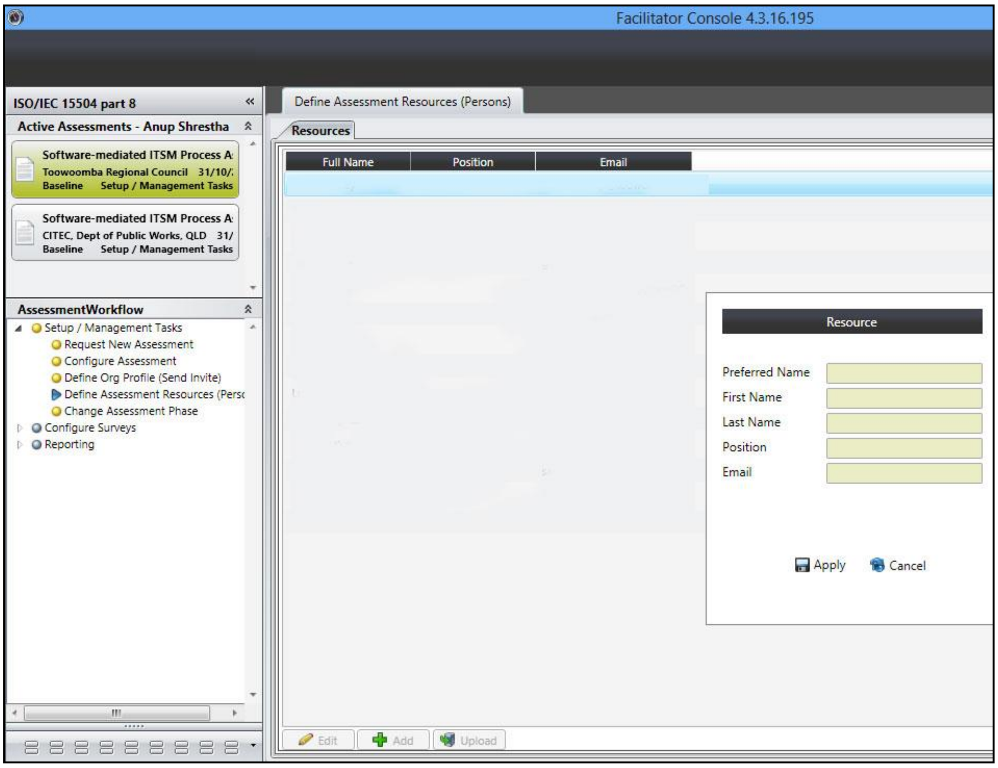
2

Appendix E.1 DSS Screenshot – Configure Assessment Details

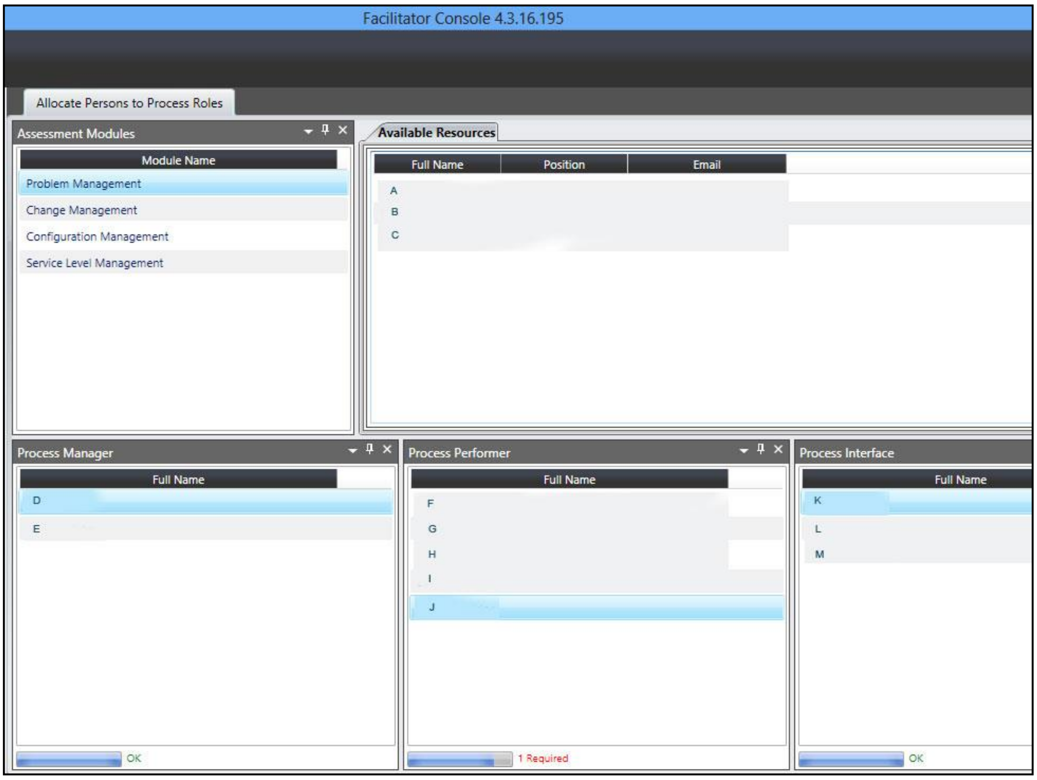


(Note: Modules in the DSS refer to ITSM processes)

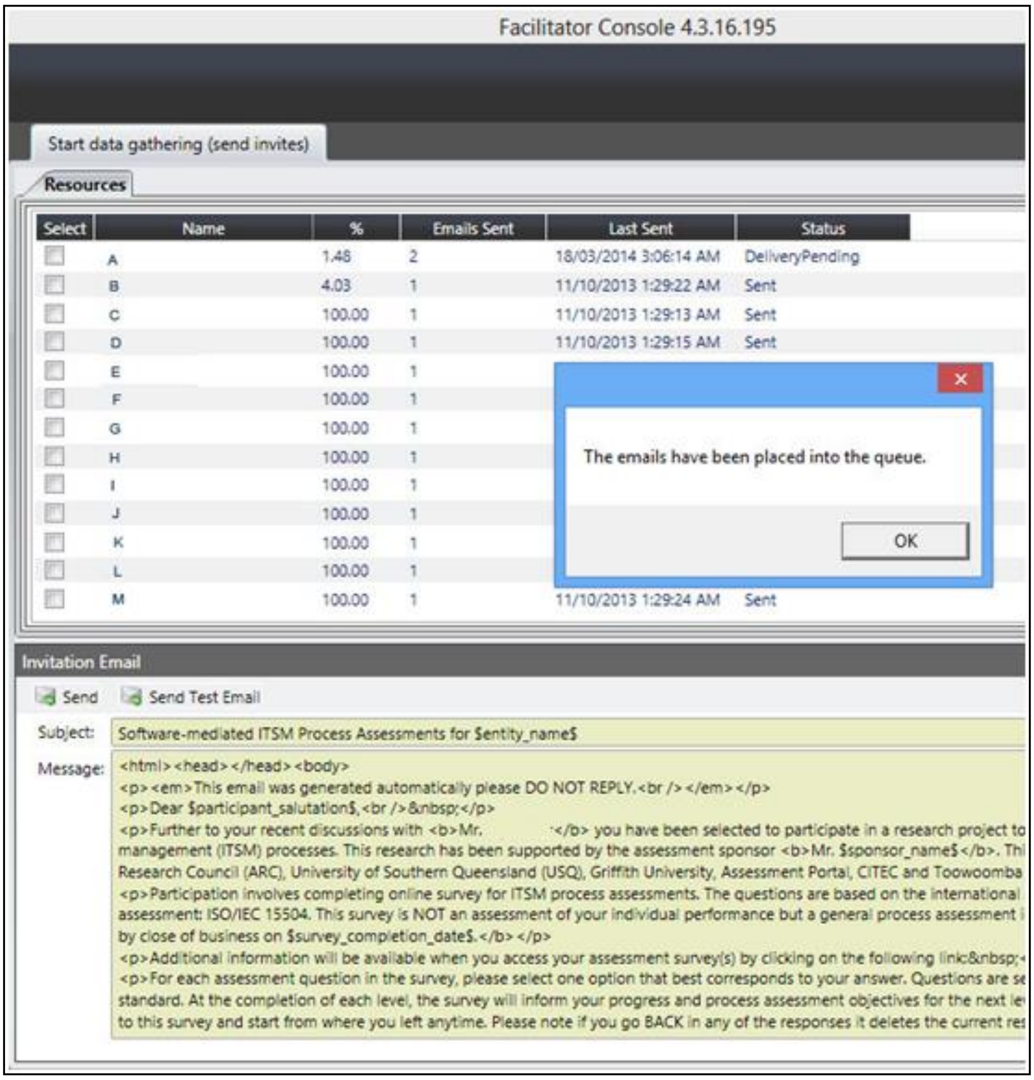
Appendix E.2 DSS screenshot – Define assessment resources (process stakeholders)



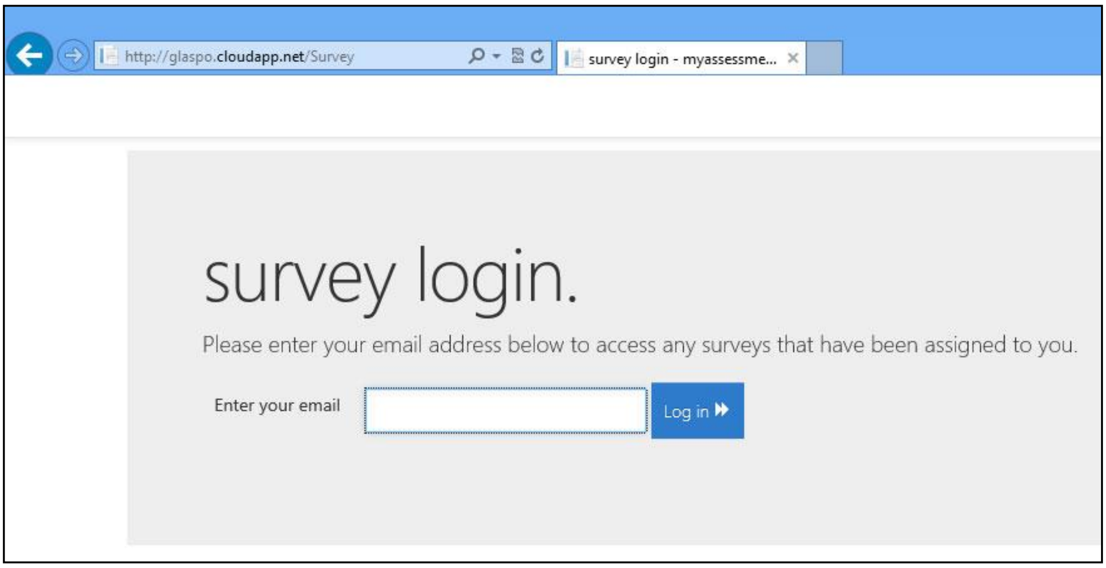
Appendix E.3 DSS Screenshot – Allocate Survey Participants to Process Roles



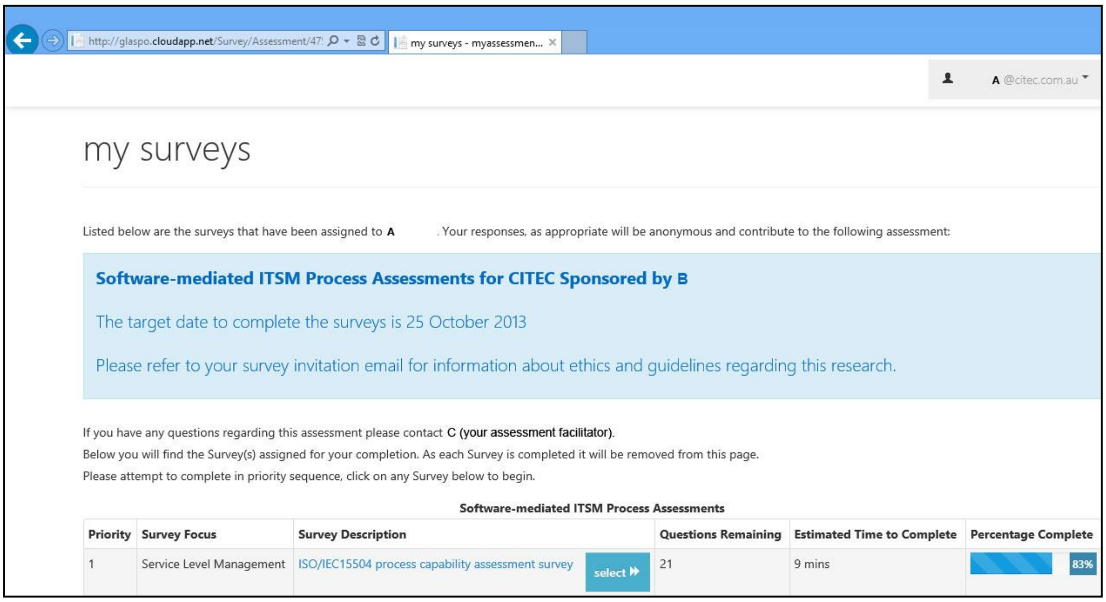
Appendix E.4 DSS screenshot – Emailing survey links



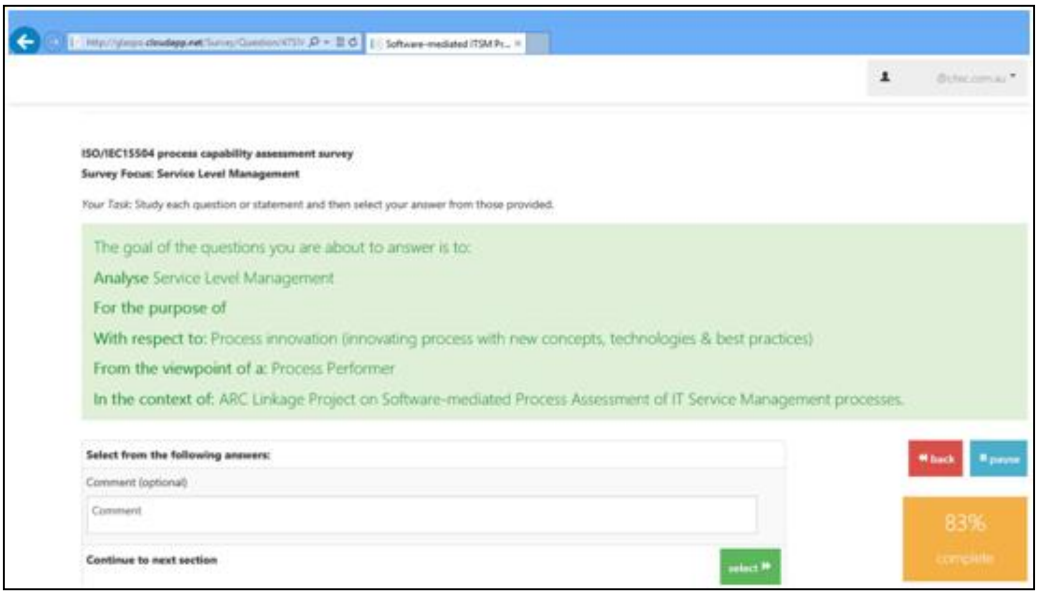
Appendix E.5 DSS Screenshot – Survey Login



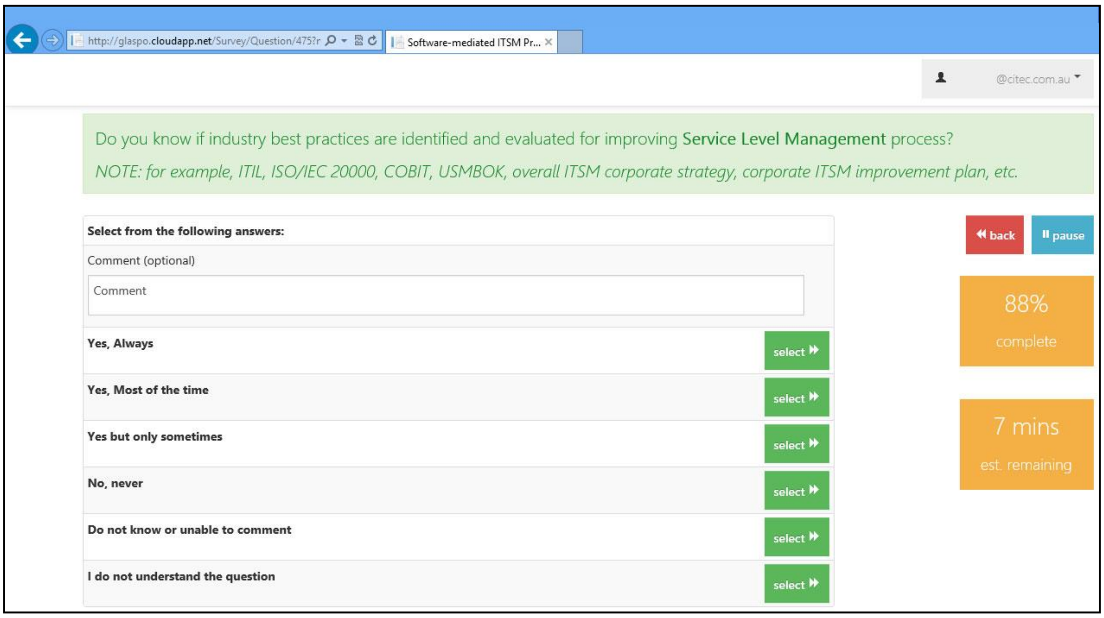
Appendix E.6 DSS Screenshot – Welcome Page After Login



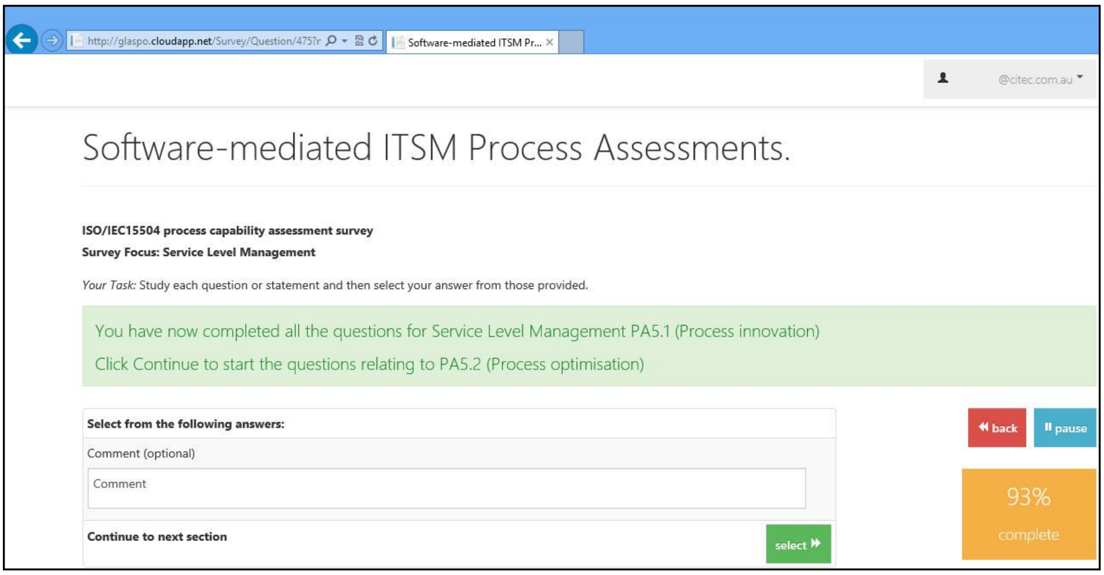
Appendix E.7 DSS screenshot – Goal Statement Page



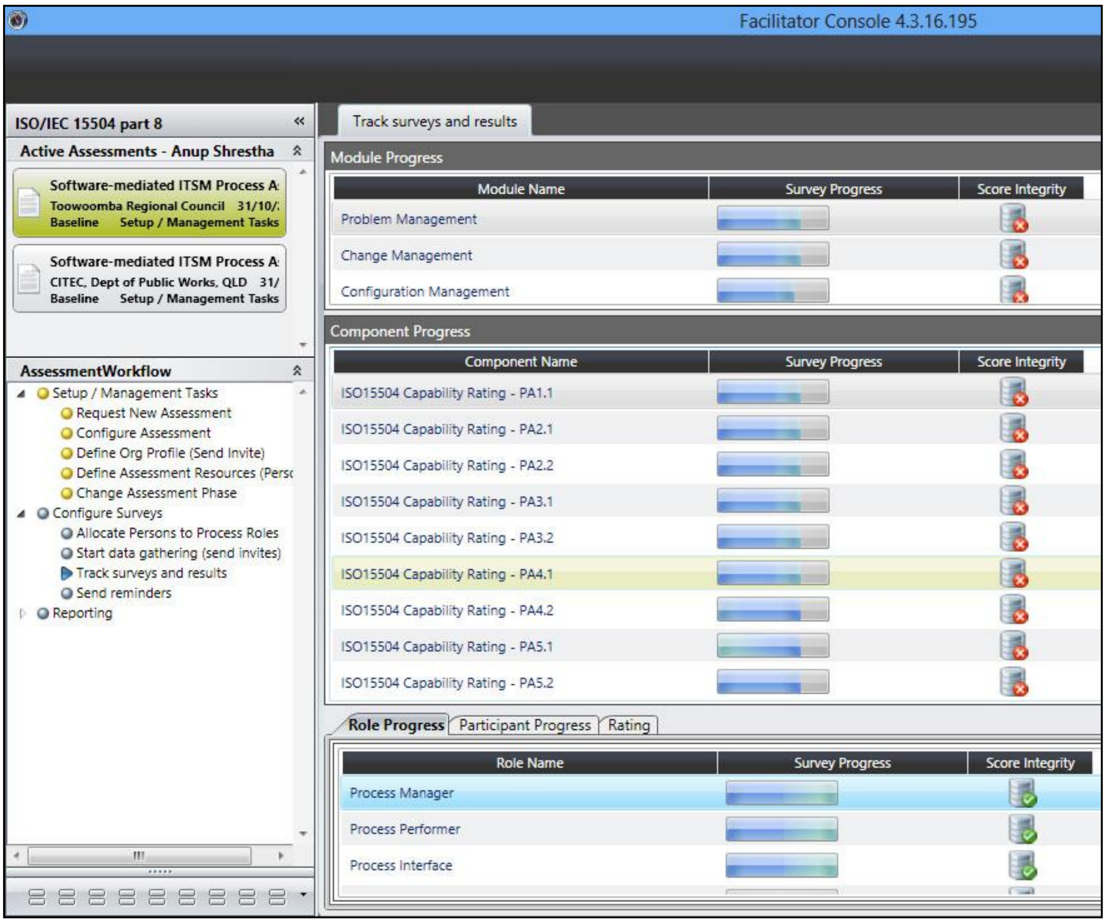
Appendix E.8 DSS Screenshot – Survey Question Page



Appendix E.9 DSS Screenshot – End of a Survey Section



Appendix E.10 DSS Screenshot – Survey Tracking



(Note: Modules in the DSS refer to ITSM processes; Components in the DSS refer to the process attributes of the ISO/IEC 15504 standard)

Appendix F.1 Typical Activities in a RAPID Assessment

The first hour of the discussion serves to familiarise the organisation participants with the purpose and method used in the assessment. “Service level management” was the first process discussed; it helped to focus the assessment on the key drivers for the business – meeting the clients' needs – and took longer than other processes as it also introduced the general approach. Once many of the concepts of the process attributes to be assessed had been introduced, overall progress through the measurement scale could be assessed faster. Following completion of the discussion on Service level management, the organisation's approach to “service planning” and “problem management” were discussed. Discussion of the “change management” and “configuration management” processes followed.

Typical schedule of activities followed during RAPID assessment

<table>
<tr><th>Time</th><th>Phase</th><th>Activity</th></tr>
<tr><td>8:30</td><td rowspan="2">Discussion kick-off</td><td>Team brief</td></tr>
<tr><td>9.00</td><td>Opening briefing</td></tr>
<tr><td>9.30</td><td rowspan="2">Data Collection</td><td rowspan="2">Discussion – Service delivery personnel</td></tr>
<tr><td>10.00</td></tr>
<tr><td>10:30</td><td colspan="2">Team Review</td></tr>
<tr><td>11.00</td><td>Data Collection</td><td>Discussion – Service planning personnel</td></tr>
<tr><td>11:30</td><td rowspan="3">Data Collection</td><td rowspan="3">Discussion – Management Group
service level management, service planning, problem management, change management, configuration management</td></tr>
<tr><td>12.00</td></tr>
<tr><td>12:30</td></tr>
<tr><td>1.00</td><td colspan="2" rowspan="2">Lunch</td></tr>
<tr><td>1:30</td></tr>
<tr><td>2.00</td><td rowspan="4">Team consensus session</td><td rowspan="4">Data validation and process rating</td></tr>
<tr><td>2:30</td></tr>
<tr><td>3.00</td></tr>
<tr><td>3:30</td></tr>
<tr><td>4.00</td><td>Feedback and closure</td><td>Review and Summary</td></tr>
<tr><td>4:30</td><td colspan="2">End</td></tr>
</table>

Appendix F.2 Process selection method interview script

Script for Process Selection Method Evaluation Interview

This script is intended to be used as a protocol for interviews with the IT service managers and service beneficiaries to collect data in order to evaluate the experience of using the process selection method as part of the SMPA approach *Phase 1 Preparation* in an organisation. In relation to this interview:

- Narrative is in normal font;
- Instructions for the researcher are highlighted in (***bold italics and in brackets***);
- Interview questions are in **bold**;
- Bullet points denote relevant probing questions; and
- Relevant usability factors are highlighted in **[bold and in square brackets]**.

Operational definitions of usability factors used in the evaluation of the process selection method is listed below.

Usability characteristic	**Operational definition**
Effectiveness	**Accuracy and transparency** of the process selection method
Efficiency	**Time, cost and resources** required for the process selection method
Usefulness	**Perceived utility** of the process selection method
Trust	Confidence in the **validity** of the process selection method

Introduction

Thank you for agreeing to assist with my research. Please read the participant information sheet and review the topics I will be asking questions about.

(Hand out the Interview Participant Information Sheet hard copy to the participant(s) and give some time to read this if they had not reviewed this before)

In summary, my research involves development of a software-mediated approach to assess ITSM processes, called the SMPA approach. At this stage, I have developed and implemented the process selection method for the SMPA approach at (*organisation name*). I will be asking some questions to help evaluate the usability of the process selection method based on your experience of the method.

(Hand out the Consent Form for Participants and allow them time to read this and date and sign this, collect the consent forms back)

The interview will be short and will only take approximately fifteen minutes of your time. Please be assured that your responses and comments will be treated as strictly confidential, and any comments you make will not be traceable back to yourself or to (*organisation name*).

No recordings will be made for this interview session.

(If background noise looks like causing a problem, ask for the door to be closed, phones to be diverted, computers to be turned down, mobile phones switched off, etc.)

Process Selection Method Evaluation

First of all, thank you for using the process selection method at your organisation. Regarding the method…

1. **Can you tell me about your experience of the process selection method?**
    - What do you think about the accuracy of the process selection method? [**Effectiveness**]
    - How much resources were required to conduct the process selection method? [**Efficiency**]
    - What do you think about the practicality of the process selection method? [**Usefulness**]
    - As a service manager/ service beneficiary, do you think that the process selection method affirms your decisions to select processes to improve? [**Trust**]
    - Specific experience of the different steps in the process selection method:
        i. Business drivers ranking exercise
        ii. Business driver score
        iii. IT service gap perception survey
        iv. Discussion of IT service gap profile
        v. Categorising ITSM processes based on consensus
        vi. Service gap perception score
        vii. Decision making with the help of the process selection matrix

2. **What do you think about the following features of the process selection method?**
    - Use of the Balanced Scorecard
    - Use of the SERVQUAL model
    - Use of the DSS

3. **In what ways can the process selection method be improved to conduct assessments?**

Summary

That concludes the specific questions. Finally…

4. **Do you have any aspects of the process selection method that you strongly like or dislike?**

Do you have any further comments you would like to make?

Finish

Thank you very much for your time, and your contribution to my research. I will be in touch with you in emails sending the interview transcripts for your confirmation and updates (if any) regarding what you said about the evaluation of the SMPA approach. Here are my details should you wish to contact me.

(Give your business card)

Thanks again for your help and making this time to us from your busy schedule.

Appendix F.3 Online Survey Evaluation Focus Group Discussion Script

Script for Online Survey Evaluation through Focus Group Discussion

This script is intended to be used as a protocol for focus group discussion with all survey participants to collect data in order to evaluate the experience of completing an online assessment survey as part of the SMPA approach *Phase 2 Online survey* in an organisation. In relation to this focus group discussion:

- Narrative is in normal font;
- Instructions for the researcher are highlighted in (***bold italics and in brackets***);
- Interview questions are in **bold**;
- Bullet points denote relevant probing questions; and
- Relevant usability factors are highlighted in **[bold and in square brackets]**.

Operational definitions of usability factors used in the evaluation of online assessment survey is listed below.

Usability Characteristic	Operational definition
Effectiveness	**Accuracy and transparency** of the online assessment survey
Efficiency	**Time, cost and resources** required for the online assessment survey
Usefulness	**Representative and understandable assessment questions to answer** in the online assessment survey
Trust	Confidence in **validity** of the online assessment survey
Comfort	**Ease** of using online assessment survey

Introduction

Thank you for agreeing to assist with my research. Please read the participant information sheet and review the topics I will be asking questions about.

(Hand out the Interview Participant Information Sheet hard copy to the participant(s) and give some time to read this if they had not reviewed this before)

In summary, my research involves development of a software-mediated approach to assess ITSM processes, called the SMPA approach. At this stage, I have developed and implemented a DSS for the SMPA approach at (*organisation name*). I will be asking some questions to help evaluate the usability of the DSS based on your experience of the online survey.

(Hand out the Consent Form for Participants and allow them time to read this and date and sign this, collect the consent forms back)

The focus group will take approximately 1.5 hours. Please be assured that your responses and comments will be treated as strictly confidential, and any comments you make will not be traceable back to yourself or to (*organisation name*).

USQ ARC LP Project – SMPA Evaluation Online Survey Evaluation Focus Group Discussion

Do you mind if I record this session, so I can focus on what you are saying, and not on taking notes?

(If background noise looks like causing a problem, ask for the door to be closed, phones to be diverted, computers to be turned down, mobile phones switched off, etc.)

Online Assessment Survey Evaluation

First of all, thank you for filling out the assessment surveys. Regarding the survey…

1. **Can you tell me about your experience of the online assessment surveys?**
    - Do the questions apply to the processes being assessed? [**Usefulness**]
    - What do you think of the page layout? Was the survey interface (not the questions) easy to use? [**Comfort**]
    - Was there too many or not enough questions? [**Efficiency**]
    - Did you find the questions easy or difficult to answer and understand? [**Usefulness**]
    - Did you select a lot of "Don't Know" options – If yes, WHY? [**Usefulness**]
    - Did you enter comments – WHY or WHY NOT? [**Comfort**]

2. **What challenges did you encounter filling in the online assessment surveys?**
    - Online assessment surveys or manual assessment interviews by an external or internal assessor – which method do you prefer to give information? [**Effectiveness**]
    - Were the questions more challenging/ difficult to answer as you move up in the capability levels? [**Usefulness**]
    - Would the surveys be more challenging/ difficult to answer if you had multiple surveys for multiple roles in different processes? [**Efficiency**]

3. **What are the current and potential benefits of surveys in ITSM process assessments?**
    - Asking direct questions in an online survey makes assessment results more visible? [**Effectiveness**]
    - Feeling of equality with an equal and anonymous say (more democratic approach)? [**Effectiveness**]
    - Reduced cost and resource requirements to conduct online survey assessments? [**Efficiency**]
    - Questions are easier to understand in online surveys? [**Usefulness**]
    - More trustworthy to answer online surveys than interviews? [**Trust**]
    - Time saving and flexibility to answer assessment questions in the comfort of your own desk/ tablet? [**Comfort**]
    - Anything else?

2

4. **What are the current and potential challenges of surveys in ITSM process assessments?**
   - Asking direct questions in an online survey does not gather accurate responses? [**Effectiveness**]
   - Answering questions without any discussion is not transparent? [**Effectiveness**]
   - Online survey assessments are more expensive? [**Efficiency**]
   - Questions are difficult to understand and could not be clarified in online surveys? [**Usefulness**]
   - More trustworthy to speak with a human rather than online surveys? [**Trust**]
   - Answering assessment questions in the comfort of your own desk/ tablet is exhausting? [**Comfort**]
   - Anything else?

5. **How well do you think the assessment task was handled by the online survey?**
   - **Task challenges:**
     i. Did online surveys address *lack of transparency* in assessments?
     ii. Did online surveys address *high costs and resource requirements* in assessments?
   - **Design principles:**
     i. Did online survey *facilitate transparent* assessments?
     ii. Did online survey *automate* assessments to make them *efficient*?

6. **In what ways can the online survey be improved to conduct assessments?**

Summary

That concludes the specific questions. Finally…

7. **Do you have any aspects of the online assessment survey that you strongly like or dislike?**

Do you have any further comments you would like to make before I turn off the audio recorder?

(Pack up recorder, notes, etc. and note any significant observations)

Finish

Thank you very much for your time, and your contribution to my research. I will be in touch with you in emails sending the interview transcripts for your confirmation and updates (if any) regarding what you said about the evaluation of the SMPA approach. Here are my details should you wish to contact me.

(Give your business card)

Thanks again for your help and making this time to us from your busy schedule.

Appendix F.4 SMPA Facilitation Evaluation Interview Script

Script for SMPA Facilitation Evaluation Interview

This script is intended to be used as a protocol for interviews with the assessment facilitators to collect data in order to evaluate the experience of using the DSS of the SMPA approach to facilitate the entire assessment method and in particular views about *Phase 3 Measurement* of the SMPA approach in an organisation. In relation to this interview:

- Narrative is in normal font;
- Instructions for the researcher are highlighted in (***bold italics and in brackets***);
- Interview questions are in **bold**;
- Bullet points denote relevant probing questions; and
- Relevant usability factors are highlighted in **[bold and in square brackets]**.

Operational definitions of usability factors used in the evaluation of SMPA approach facilitation is listed below.

Usability Characteristics	**Evaluation focus**	**Operational Definition**
Effectiveness	Assessment workflow management	**Accuracy and transparency** of SMPA approach workflow management
Efficiency	Assessment workflow management	**Time, cost and resources** required for SMPA approach workflow management
Usefulness	Facilitator console	**Automation in assessment workflow** by using facilitator console
Trust	Process measurement	Confidence in **validity** of the measurement phase of the SMPA approach
Comfort	Facilitator console	**Ease** of using facilitator console

Introduction

Thank you for agreeing to assist with my research. Please read the participant information sheet and review the topics I will be asking questions about.

(Hand out the Interview Participant Information Sheet hard copy to the participant(s) and give some time to read this if they had not reviewed this before)

In summary, my research involves development of a software-mediated approach to assess ITSM processes, called the SMPA approach. At this stage, I have developed and implemented a DSS for the SMPA approach at (*organisation name*). I will be asking some questions to help evaluate the usability of the DSS based on your experience with the facilitator console in the role of an assessment facilitator.

(Hand out the Consent Form for Participants and allow them time to read this and date and sign this, collect the consent forms back)

The interview will take approximately one hour. Please be assured that your responses and comments will be treated as strictly confidential, and any comments you make will not be traceable back to yourself or to (*organisation name*).

Do you mind if I record this session, so I can focus on what you are saying, and not on taking notes?

(If background noise looks like causing a problem, ask for the door to be closed, phones to be diverted, computers to be turned down, mobile phones switched off, etc.)

SMPA Approach Facilitation Evaluation

First of all, thank you for facilitating the SMPA approach at your organisation. Regarding the SMPA approach…

1. **Can you tell me about your experience of the facilitation process?**
    - What do you think about the workflow management of the SMPA approach? [**Effectiveness**]
    - How much resources were required to facilitate the SMPA approach? [**Efficiency**]
    - What do you think about the facilitator console of the DSS? [**Usefulness**]
    - As a facilitator, do you think that the processing of the DSS is valid? [**Trust**]
    - Would you be comfortable to facilitate another SMPA approach? [**Comfort**]

2. **What are the current and potential benefits of using a DSS in ITSM process assessments?**
    - Makes assessment process more transparent? [**Effectiveness**]
    - Reduced cost and resource requirements to conduct assessments? [**Efficiency**]
    - DSS is capable to facilitate assessments? [**Usefulness**]
    - Results from SMPA approach is likely to be reliable? [**Trust**]
    - DSS provides confidence in the assessment results? [**Trust**]
    - Facilitator console interface seems easy to use? [**Comfort**]
    - Anything else?

3. **What are the current and potential challenges of using a DSS in ITSM process assessments?**
    - Assessment process does not seem accurate? [**Effectiveness**]
    - SMPA approach using a DSS can be more expensive? [**Efficiency**]
    - DSS does not automate assessments well? [**Usefulness**]
    - Results from SMPA approach is more error-prone? [**Trust**]
    - Facilitator console interface seems confusing? [**Comfort**]
    - Anything else?

4. **How well do you think the assessment process was handled by the DSS?**
    - **Task challenges:**

i. Did DSS address *lack of transparency* in assessments? (Adequate? Useful? Compatible? Helpful? Sufficient?)
ii. Did DSS address *high costs and resource requirements* in assessments? (Reduce the assessment effort?)

- **Design principles:**
  i. Did DSS *facilitate transparent* assessments?
  ii. Did DSS *automate* assessments to make them *efficient*?

5. **In what ways can the DSS be improved to facilitate assessments?**

Summary

That concludes the specific questions. Finally…

6. **Do you have any aspects of the DSS or the facilitator console that you strongly like or dislike?**

Do you have any further comments you would like to make before I turn off the audio recorder?

(Pack up recorder, notes, etc. and note any significant observations)

Finish

Thank you very much for your time, and your contribution to my research. I will be in touch with you in emails sending the interview transcripts for your confirmation and updates (if any) regarding what you said about the evaluation of the SMPA approach. Here are my details should you wish to contact me.

(Give your business card)

Thanks again for your help and making this time to us from your busy schedule.

Appendix F.5 Outcome Evaluation Interview Script

Script for Outcome Evaluation Interview

This script is intended to be used as a protocol for interviews with the process managers to collect data in order to evaluate the outcome of the SMPA approach, i.e. the SMPA report regarding the expected utility of the report for decision making to improve the ITSM processes. This relates to *Phase 4 Improvement* of the SMPA approach in an organisation. In relation to this interview:

- Narrative is in normal font;
- Instructions for the researcher are highlighted in (***bold italics and in brackets***);
- Interview questions are in **bold**;
- Bullet points denote relevant probing questions; and
- Relevant usability factors are highlighted in **[bold and in square brackets]**.

Operational definitions of usability factors used in the evaluation of the SMPA report is listed below.

Usability Characteristic	**Operational definition**
Effectiveness	**Expected decision quality** in terms of accuracy and transparency of the SMPA report
Efficiency	**Expected decision efficiency** in terms of time and effort required to use the SMPA report
Usefulness	**Expected utility** of the SMPA report for process improvement
Trust	Confidence in **validity** of the SMPA report

Introduction

Thank you for agreeing to assist with my research. Please read the participant information sheet and review the topics I will be asking questions about.

(Hand out the Interview Participant Information Sheet hard copy to the participant(s) and give some time to read this if they had not reviewed this before)

In summary, my research involves development of a software-mediated approach to assess ITSM processes, called the SMPA approach. I have already developed and implemented a DSS for the SMPA approach at (*organisation name*). I have conducted a number of interviews to evaluate the usability of the SMPA approach. At this stage, the SMPA report has been provided for your perusal as the outcome of the SMPA approach. We have also conducted a manual process assessment and provided the manual assessment report. I will be asking some questions to help evaluate the usability of the outcome of the SMPA approach based on your experience of going through the SMPA report in comparison to the manual assessment report.

(Hand out the Consent Form for Participants and allow them time to read this and date and sign this, collect the consent forms back)

The interview will take approximately one hour. Please be assured that your responses and comments will be treated as strictly confidential, and any comments you make will not be traceable back to yourself or to (*organisation name*).

Do you mind if I record this session, so I can focus on what you are saying, and not on taking notes?

(If background noise looks like causing a problem, ask for the door to be closed, phones to be diverted, computers to be turned down, mobile phones switched off, etc.)

Outcome (SMPA Report) Evaluation

First of all, thank you for going through the SMPA report presented for your consideration. Regarding the SMPA report…

1. **Can you tell me about your experience of going through the SMPA report?**
    - Can the report be used to making decisions on process improvements? [**Effectiveness**]
    - What are the time and effort required to use the SMPA report? [**Efficiency**]
    - What do you think about the practicality of the SMPA report? [**Usefulness**]
    - Do you believe what has been presented in the SMPA report? [**Trust**]
    - Anything else?

2. **Do the process improvement recommendations in the SMPA report enable you to make better quality decisions? [Effectiveness – expected decision quality]**
    - If YES, in what ways? If NO, why?
    - How *accurate* are the improvement recommendations?
    - How *precise/ actionable* are the improvement recommendations?
    - How *dependable/ relevant* are the improvement recommendations?
    - Could this report (and similar reports in future) facilitate continual service improvement in your organisation?

3. **Do you think the process improvement recommendations in the SMPA report enable you to make decisions quickly and with ease? [Efficiency – expected decision efficiency]**
    - If YES, in what ways? If NO, why?
    - Do you think you can *save time* using the SMPA report?
    - Do you think you can arrive at a recommendation for the most appropriate decision *sooner* using the SMPA report?
    - With the use of the report, do you think you are able to *accomplish more tasks*?

Based on your experiences with the SMPA approach and the manual process assessment exercise….

4. **How do the two methods (SMPA approach and manual assessment) compare?**
    - Which method would you prefer to participate in?
    - Which method do you think provides the most reliable process capability rating?
    - Based on the two reports, which method do you think provides the most practical action items for process improvement?
    - Are there cost/resource considerations when comparing self-assessments in the SMPA approach with engaging consultants for manual assessments?
    - Can you suggest specific situations where one method may be more appropriate than the other?
    - Which method do you think you are likely to use in your organisation in future?

5. **In what ways can the SMPA report be improved to give the best value for process improvements?**

Summary

That concludes the specific questions. Finally…

6. **Do you have any aspects of the SMPA report that you strongly like or dislike?**

Do you have any further comments you would like to make before I turn off the audio recorder?

(Pack up recorder, notes, etc. and note any significant observations)

Finish

Thank you very much for your time, and your contribution to my research. I will be in touch with you in emails sending the interview transcripts for your confirmation and updates (if any) regarding what you said about the evaluation of the SMPA approach. Here are my details should you wish to contact me.

(Give your business card)

Thanks again for your help and making this time to us from your busy schedule.

Appendix F.6 Excerpts of SMPA Report

Software-mediated ITSM Process Assessments Report for

<ORGANISATION>

Commercial in Confidence

Prepared by: Software-mediated ITSM Process Assessment Tool, developed as part of USQ Australian Research Council Linkage Project on ITSM
Date: 5 December 2013

1.0 Introduction

The purpose of this report is to present the process capability results and to provide process improvement recommendations following the **software-mediated process assessment** approach for one ITSM process: Problem Management in **<ORGANISATION>**. The software facilitates the process assessment approach in the following three steps:

1. **Online surveys** were used to collect information for process assessment in the software. Questions were based on the **process assessment model** from **ISO/IEC 15504 part 8** (an exemplar process assessment model for ITSM). This was conducted between **<START DATE>** and **<END DATE>**.

2. **Process capability ratings** were calculated by the software using the measurement framework of **ISO/IEC 15504-2**. The average score based on all respondents along with the reliability of the score based on the responses consistency were determined by the software.

3. **Assessment report** (*this report*) was generated by the software. This report presents the process capability scores and provides process improvement recommendations when any area of process demonstrates risk (a score of *partial achievement* or lower). The process improvement recommendations are sourced from a knowledge base in the software that has been developed based on ITIL® and ISO/IEC 20000 guidelines. This assessment report was produced on <REPORT DATE>.

Where any aspect of the process presents risks or non-conformance, the recommendation provides some commentary on what the desired state should be. These recommendations demonstrate areas to address the risks observed during process assessments and are best practice guidelines only. They do not provide specific recommendations based on your organisation context.

During the online surveys, participants had the option to provide comments. These are listed in the Appendix section against the process where the comments were applied. They provide anecdotal information that may prompt further improvement action. The comments section is the only section of this report that is manually reviewed by the assessment facilitator in order to de-identify any comments that may directly point to individuals or specific process activities they perform.

Besides the comments, the appendix section also provides information about assessment scope, the software-mediated process assessment approach followed to produce this report and the assessment participants.

Table of Contents

2.0 Organisation Profile

The following Organisation Profile was agreed and provided by <ORGANISATION>

Profile	Response
BACKGROUND (ORGANISATION)	
Industry	
Supplier Profile	
Business Geography Spread	
Governance	
Current Business Drivers	
Business Driver for ITSM Process Improvement	
BACKGROUND (ORGANISATION UNIT)	
Headquarters vs. Organisation Unit Location	
Organisation Unit Geography Spread	
Organisation Unit Annual Budget	
Organisation Unit Structure	
Current Organisation Unit Driver	
Dependency with partners or suppliers for service delivery	
Funding Model for Organisation Unit	
STAFF PROFILE	
Organisation Unit Staff Size	
Staff Turnover	
Contractor Percentage	
Current level of staff ITIL awareness	
Staff with formal ITSM certification (ITIL, ISO/IEC 20000)	
PROCESS ASSESSMENT PROFILE	
Assessment Engagement Level	
Process Assessment Driver	
Past Assessment Experience	
Current predominant ITSM tool in use	

3.0 Problem Management

According to ISO/IEC 20000-4, the purpose of the problem management process is to minimise service disruption. As a result of successful implementation of Problem Management process, the expected outcomes are:

- problems are identified, recorded and classified;
- problems are prioritised and analysed;
- problems are resolved and closed;
- problems which are not progressed according to agreed service levels are escalated;
- the effect of unresolved problems is minimised; and
- the status and progress of the resolution of problems are communicated to interested parties.

3.1 Problem Management Assessment Profile

	Level 1	Level 2		Level 3		Level 4		Level 5	
Profile	Process Performance	Performance Management	Work Product Management	Process Definition	Process Deployment	Process Measurement	Process Control	Process Innovation	Process Optimisation
Rating Score	L	L	L	L	L	L	P	N/A	N/A
Score Reliability *	High	High	High	High	High	Moderate	Poor		
Number of responses	4	4	4	4	4	4	4		

Label:

F	**Fully**	There is certainty that process activities are usually performed.
L	**Largely**	Process activities are performed in the majority of cases.
P	**Partially**	Process activities are performed but not frequently.
N	**Not**	Process activities are not or rarely performed.

* Score Reliability is based on ***coefficient of variation (CV)*** that measures dispersion of responses from the average rating score at each process capability level.

- "High" score reliability when CV is below 30%
- "Moderate" score reliability for CV between 30 and 50%
- "Poor" score reliability for CV above 50%

In order to generate the assessment profile for Problem Management, **76%** of assessment survey responses were considered. Remaining responses were not applicable for score calculation. The assessment response breakdown chart in Figure 3.1.1 illustrates valid answers considered for process capability scores (responses of Fully, Largely, Partially and Not) against "Don't Know" and "Don't understand the Question" responses.

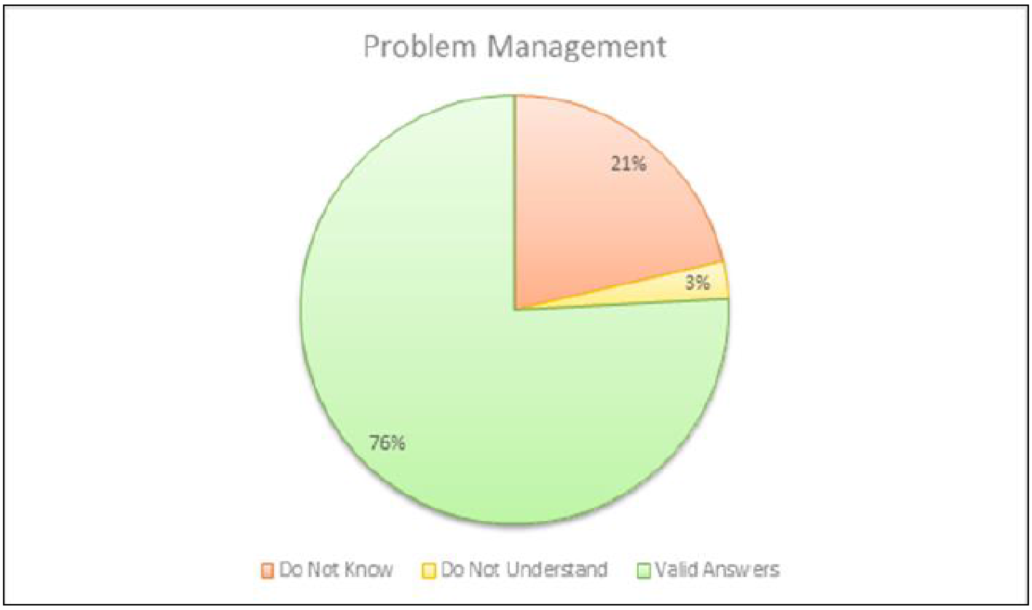


Figure 3.1.1: Problem Management survey questions response breakdown

3.2 Problem Management – Process Improvement Recommendations

Table 3.2.1 below presents all knowledge items relating to how well the problem management process has achieved its purpose and expected outcomes. These recommendations and the level of achievement determined by survey responses provide specific guidelines to optimally perform Problem Management process activities (also called **base practices** in the standard).

Score rating provides an overall score (Fully, Largely, Partially & Not) for how well the recommended action is performed based on the responses to the question related to each standard indicator. **Score reliability** defines how reliable the score rating is (High, Moderate, Poor) based on the degree of variation in the responses.

The recommendation items for process improvement guidelines presented in Table 3.2.1 are defined to guide specific activities of the Problem Management process. If any of the level of achievements is not F (i.e. there is no certainty these process activities are usually performed); those activities must be reviewed and performed according to the recommendations provided to fully achieve Capability Level 1.

Table 3.2.1 Problem Management Process Performance – Base Practices (Level 1)

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
RES3.1	Problems should be comprehensively identified from different sources. Consider the following scenarios and ensure problems are properly identified in these cases, among others: • The service desk may identify an unknown cause of one or more incidents and registers a problem. • The technical support group may identify an underlying problem while analysing an incident. • An event or alert tool in the ITSM software may automatically trace an error that registers problems. • A supplier may report a problem that they identified. • Proactive problem management activities may identify problems during analysis of incidents.	L (High)
RES3.1	Identified problems should be properly recorded. In most cases, it means an entry in the ITSM software tool. This ensures that a comprehensive historic problem report could be made available for control and escalation if required.	L (High)
RES3.1	Problems should be accurately classified (for example: problem areas could be hardware, network, and software). This helps in analysing the cause of and solution to the problem quickly.	P (Moderate)
…	…	…

Table 3.2.2 below presents recommendations for all **generic practices** of the problem management process, i.e. from capability level 2 (PA2.1) to capability level 5 (PA5.2). These recommendations are extracted from the knowledge base only when any process area demonstrates significant risks (when the final score of any question is either P or N).

The recommendation items for process improvement guidelines presented in Table 3.2.2 are defined at a broader level. Discussions with key stakeholders of the problem management process are very important to consider these recommendations; contextualise them to your organisation & process environment; and finally produce actionable items to address the risks in the process areas as highlighted in the table. This will ensure the progressive achievement of process capability scores above Capability Level 1.

Table 3.2.2 Problem Management - Generic Practices (Levels 2 to 5)

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	2.1: Performance Management	
GP2.1.2	The activities of Problem Management should be driven by the identified performance targets so that the Problem Management can be monitored against the plans.	P (High)
GP2.1.3	If new performance targets are set, the Problem Management activities should be properly rescheduled to address the changes in the activities.	P (Moderate)
…	…	…

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	2.2 Work Product Management	
	No significant process risks identified in this process attribute for Problem Management process.	

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	3.1 Process Definition	
GP3.1.5	There should be a repository of knowledge based on the experience of the implementation of the standard Problem Management process which should be used for understanding and improvement of the standard process.	P (Moderate)
…	…	…

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	3.2: Process Deployment	
GP3.2.6	The analysis of appropriate data regarding implementation of the Problem Management process should be conducted to provide a basis for understanding the behaviour of the process and its compliance with the standard Problem Management process. This, in turn, contributes to the ongoing improvement of the implemented process and the standard Problem Management process upon which the implemented process is based.	P (Poor)
GP3.2.3	The current competencies of Problem Management staff should be ascertained to ensure whether they are adequate to perform Problem Management activities or not. If they are inadequate, hiring competent staff and training existing staff properly should be considered.	P (High)

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	4.1: Process Measurement	
GP4.1.1	Relevant business goals should be defined to establish quantitative Problem Management KPIs. The business goals should be aligned to specific process metrics to determine the extent of achievement of the organisation's business goals.	N (High)
GP4.1.4	It is important to define relevant metrics that are linked to performance targets to support measurement of Problem Management process goals. Some relevant metrics could be actual time taken for a service delivery, actual cost of service, percentage of satisfaction rating, availability, capacity and continuity of a service or its components.	P (Moderate)
…	…	…

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	4.2 Process Control	
GP4.2.1	Techniques for process control should be defined for Problem Management in order to effectively measure and use measurement results for understanding process performance. The techniques chosen for process control are influenced by the type of process and the context of organisation being assessed. Typical processes are suited to statistical control to identify root cause of variations in achieving process KPIs. However, alternative qualitative techniques such as Pareto analysis and fishbone diagrams could be selected as well depending on the process type and organisation context.	N (High)
GP4.2.1	The objectives of Problem Management process control should be used to validate selection of the process control techniques to demonstrate that appropriate techniques are used. Two main objectives of process control are: • to identify root causes of variations in process performance, and • to be able to predict process outcomes within defined limits. The selected process control techniques therefore should be validated to meet the objectives of process control.	P (Poor)
…	…	…

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	5.1: Process Innovation	
	This process attribute was not assessed.	

Standard Indicator	Observation & Recommendation	Score Rating & Reliability
	5.2: Process Optimisation	
	This process attribute was not assessed.	

4.0 Conclusion

This assessment report presents the current process capabilities and improvement recommendations at <ORGANISATION> for one process selected for assessment: Problem Management. Improving processes based on the assessment report is important to ensure that the organisation unit maximises its value to business as a service provider.

The assessment report is expected to be used as a starting point in the process improvement journey for continual service improvement. The report has to be contextualised based on the specific organisation profile, discussed with key stakeholders and updated based on organisation culture, priorities and requirements.

Appendix: Assessment Details

A. Assessment Scope

The selection of processes for assessment and the maximum capability level for assessment were provided by the assessment facilitator. The process selection functionality of the software tool can be used to help make decisions in selecting ITSM processes.

Processes selected for Assessment	Maximum Capability Level
Problem Management	Capability Level 4

B. Software-mediated Process Assessment Approach

1. Context → 2. Scope → 3. Preparation → 4. Data Collection → 5. Data Analysis → 6. Reporting

1. **Context:** Organisation profile was provided by the assessment facilitator. The software tool captured this information and it was used to produce the organisation profile for <ORGANISATION> (*page 3* of this report).

2. **Scope:** ITSM processes to assess and the maximum capability level of assessment were provided by the assessment facilitator. The process selection functionality of the software tool can be used to help make decisions regarding which processes to select at <ORGANISATION>.

3. **Preparation:** A list of assessment participants with their relevant process roles (i.e. process managers, process performers, external process stakeholders) was provided by the assessment facilitator. The software tool was used to allocate participants to their respective roles to associate them with relevant assessment questions.

4. **Data Collection:** Online surveys were developed with questions based on the process assessment model from the international standard of process assessment (ISO/IEC 15504). Part 8 of the standard (an exemplar process assessment model for ITSM) was used to link assessment questions to the standard indicators. Survey links were emailed to all assessment participants and the progress of the assessment survey was tracked by the software tool with support from the assessment facilitator.

5. **Data Analysis:** The software tool was used to calculate process capability rating scores based on the survey responses and using the guidelines from ISO/IEC 15504-2. The software calculated a mean value score from all responses to determine process capability scores and used a *coefficient of variation* metric to determine reliability of the process capability scores. Total number of responses, Number of "Don't Know" responses and responses grouped by process roles were calculated by the software.

6. **Reporting:** Process improvement recommendations based on the guidelines for ISO/IEC 20000 and ITIL® framework were developed for all assessment questions and stored as a knowledge base in the software tool. Where the software detects risks in the process activities (process capability scores of only partial achievement or lower, at every question level), the associated knowledge items are presented as recommendations in the assessment report. The report is finally produced from the software and presented to the assessment facilitator (which is *this report*).

C. Process Attribute Description based on ISO/IEC 15504

Capability Level	Process Attribute	Description
1	1.1: Process Performance	How well the implemented process achieves its purpose and expected outcomes?
2	2.1: Performance Management	How well the performance of the process is managed?
	2.2: Work Product Management	How well the work products (inputs and outputs) produced by the process is managed?
3	3.1: Process Definition	How well a standard process is defined and maintained to support process activities?
	3.2: Process Deployment	How well the standard process is implemented as process activities to achieve its outcomes?
4	4.1: Process Measurement	How well the process is measured to ensure process activities support business goals?
	4.2: Process Control	How well the process is quantitatively managed and controlled for stable and predictable process activities within defined limits?
5	5.1: Process Innovation	How well the process is improved from process measurement, process control and innovative approaches?
	5.2: Process Optimisation	How well the process is improved from ongoing management and performance of process activities?

D. Problem Management Participant Comments

Comments from Survey Participants provide a rich source of qualitative information about process capabilities; interpretation of survey questions and responses; discussions regarding process strengths, weaknesses, opportunities and threats; and contextual information about organisation, related processes, people issues, technology factors, constraints, etc.

These comments provide useful information to help in process assessments in two ways:

(a) Feedback for further improvement of questions in the software tool
(b) Information to discuss about current process issues and improvement opportunities.

Standard Indicator	Question	Selected Answer	Associated Comment
GP2.1.2	Do you know if Problem Management activities are well aligned with a schedule?	Yes, Fully	Can you provide an example of "aligned with a schedule"
GP2.1.2	Do you know if Problem Management inputs and outputs are regularly reviewed according to a plan?	Yes, Fully	Defined in our Control Monitoring Process Management plan
GP2.1.2	Do you know if activities of Problem Management are performed according to the performance targets?	Do Not Understand	According to performance targets?? Are we not trying to meet performance targets
GP2.2.2	Do you know if requirements for the approval of Problem Management deliverables (documents) are defined? NOTE: for example, versioning, document naming, access rules and confidentiality requirements for process output documents.	Do Not Know	all records are contained in Service Now
…	…	…	…

E. Assessment Participants

We would like to thank all those who took part in this assessment particularly the following who provided information through online assessment surveys.

Assessment Sponsor

- A

Assessment Facilitator

- B

Process Managers/Owners

- C

Process Performers

- D
- E
- F

External Process Stakeholders

- G
- H
- I
- J

This report has been generated by software developed in partnership with our industry research partner: Assessment Portal Pty Ltd. (www.assessment-portal.com).