The Role of International Standards to Corroborate Artefact Development and Evaluation: Experiences from a Design Science Research Project in Process Assessment

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Abstract. International standards were used to corroborate artefact development and evaluation in a Design Science Research (DSR) project within the context of Process Assessments in IT Service Management (ITSM). While there have been significant research efforts towards extending DSR guidelines and the development and revisions of the standards, reports of the application of International Standards to validate DSR artefacts are scant. DSR, akin to any academic research, is required to demonstrate rigour and relevance with the use of theories and prior knowledge. Moreover, DSR presents an artefact as a solution to a class of problems and reports how the artefact is developed and evaluated. Our DSR project demonstrated that concerns about the quality of artefacts can be addressed and thereby the utility and validity of the artefact can be verified with the use of International Standards. Using three International Standards, process assessment ISO/IEC 15504-33000 series, IT Service Management ISO/IEC 20000, and System and Software Quality Models ISO/IEC 25010, this paper presents an account of a real-life DSR project that demonstrates the significant role of International Standards to guide DSR researchers during artefact design, development and evaluation.

Keywords: International Standards, design science research, process assessment, IT service management, software quality evaluation

1 Introduction

The primary goal of a Design Science Research (DSR) method [1, 2] is to develop a new artefact. While DSR efforts focus on the features and functionalities of the artefact, research activities must be corroborated with some evidence that the artefact was built and evaluated rigorously. Without the validation of artefact design, development and evaluation, the research contributions may not be highlighted and the artefacts could be viewed as merely unconfirmed propositions.

One of the key DSR requirements agreed by all schools of thought [3] is that the artefact development and evaluation must be validated using existing theories and guidelines. In a socio-technical context the artefact is influenced by the environment in which it operates. Previous DSR projects have used kernel theories [4, 5], case studies [6] and systematic literature reviews [7] for the corroboration of artefact design,

development and evaluation. This paper advocates that guidance on how to validate the artefact build and evaluate cycles in DSR can be obtained from the standards belonging to the International Organization for Standardization (ISO) family, referred as the "International Standards" in the remainder of this paper.

International Standards have been credited with facilitating communication in order to make information systems more consistent [8]. Since International Standards belong to the public domain and are universally applicable for transparent use [9], we assert that the use of International Standards promotes the validation of DSR artefacts during design, development and evaluation. Where applicable, DSR researchers may use available International Standards for transparency and consistency in the way research is conducted.

The role of International Standards in artefact validation can be demonstrated with its successful application to a real-life DSR project. Therefore, we report the design, development and evaluation of our artefact in which we used International Standards in a DSR project undertaken over four years (2011 – 2015). An iterative design process was followed to develop a research artefact for process assessment. Process assessment is a disciplined evaluation of an organisation unit's processes against a process assessment model (PAM) [10]. Our research artefact is named the "Software-mediated Process Assessment" (SMPA) approach that enables researchers and practitioners to assess ITSM processes in a transparent and efficient way. The four phases proposed in the SMPA approach include (a) assessment preparation; (b) online survey to collect assessment data; (c) measurement of process capability; and (d) reporting process improvement recommendations.

Three International Standards were implemented during the design, development and evaluation of the SMPA approach. The International Standard for ITSM ISO/IEC 20000 [11] provided the process reference model (PRM) for the processes to be assessed. The International Standard for process assessment ISO/IEC 15504 [12] provided support for a transparent assessment method. A decision support system (DSS) was implemented to demonstrate the use of the SMPA approach. The International Standard for Software Quality Evaluation ISO/IEC 25010 [13] provided the software quality in use model for the evaluation of the artefact that was conducted at two public-sector IT service providers in Australia. Evidence from the evaluation of the artefact indicated that the SMPA approach can be effective for process assessments [14].

The use of International Standards was a major driver in our DSR project to promote a transparent ITSM process assessment method. In this paper, we aim to report our research journey demonstrating how International Standards supported artefact design, development and evaluation, and thereby present a case for International Standards to be applied by relevant research communities for corroboration. The literature review of the DSR approach and the relevant International Standards is presented next. This is followed by a summary of our DSR project on ITSM process assessment. In the following three sections, we present the SMPA artefact design, development and evaluation with key references to the International Standards used. We discuss our research experience highlighting the role that International Standards played in the successful execution of the project. Finally, we present the conclusion and direction for future work.

2 Literature Review

2.1 Design Science Research

Several DSR authorities have provided valuable guidelines related to the development and evaluation of artefacts that form the major activities and outcome of any DSR project. Baskerville [15] 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. In DSR the design process and resultant artefact have to be at least generalised to a class of problem domains [16]. This position corresponds to the definition of meta-requirements and meta-design provided by Walls et al. [5] in their proposed design theory. March & Smith [17] discussed design science and concluded that research artefacts may be constructed in the form of a construct, method, model, or instantiation. A major contribution of a DSR study should be to develop at least some components of a design theory. With the help of design theories, an artefact can address the identified research problems, present a novel solution to the problems and confirm the utility of the solution.

Over the past decade, the Information Systems research community has formalised DSR as an acceptable and rigorous research method. However, being a relatively emerging research method, DSR in information systems has limited resources that prompts the use of guidelines such as International Standards in order to validate artefact design, development and evaluation. Gregor & Hevner [18] proposed a DSR publication schema with guidance to present DSR projects. Their work provides significant insights in showcasing how DSR makes knowledge contribution and how to publish DSR work. Despite the significance of International Standards for policy making and in practice, there is a shortage of guidance on how to use International Standards for academic research, including for artefact development which is the major outcome of any DSR project [1]. Recent authors have suggested that future research must address the need for design principles that provide guidelines to identify the problem and proposed solutions relating to an artefact [19]. Consequently, current artefacts reported in DSR studies are variably validated [20]. Our work is motivated to address this challenge by demonstrating the use of International Standards to validate DSR artefact design, development and evaluation.

2.2 International Standard for Process Assessment

We used the International Standard for process assessment ISO/IEC 15504 during the design of our research artefact in 2013. This standard is currently being revised and transformed into a new standard family of ISO/IEC 33000 series [21]. Several parts of the ISO/IEC 15504 standard that were used in our research have now been withdrawn and new ISO/IEC 33000 standards have been published. Currently ten standards associated with the ISO/IEC 33000 series are published with many more under development [21]. The new standards present a generic view with a higher abstraction level for process assessment. Building new measurement frameworks and addressing quality characteristics other than process capability are two significant changes in ISO/IEC 330xx family. The ISO/IEC 33000 standard family also provides additional

process assessment models and guidance in new areas. Readers can follow the Standards Catalogue on the ISO website for the latest standards update under the classification ICS code 35.080 IT > Software [22].

While there have been significant changes in ISO/IEC 330xx standard series (e.g. new concept of Process Quality Attribute in ISO/IEC 33001), the new standards correspond to related ISO/IEC 15504 content [21]. The measurement framework defined in ISO/IEC 15504-2 that was used in our research has been revised but remains similar to the new ISO/IEC 33020 standard. Moreover, the PAM used in our research – part 8 of the ISO/IEC 15504 – is still available and its transition into ISO/IEC 330xx family as ISO/IEC 33062 is expected to be straightforward [21]. The foundation of the ISO/IEC 15504 series has been subject of rigorous SPICE trials [23] and these have been published extensively [24]. In this light, we present an overview of the ISO/IEC 15504 standard to give a better perspective of the artefact since these standard parts were relevant during our project. We believe that the SMPA approach can be modified to meet the requirements of the new standards. In fact, the references made to ISO/IEC 15504 standards in our research can be viewed as a specific and valid instance of the ISO/IEC 330xx family in terms of the terminologies and the measurement framework. Therefore, the underlying concepts of the artefact, including the role of International Standards as highlighted in this paper, remain the same.

ISO/IEC 15504 defines six process capability levels: 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. Process assessment is conducted in a standard manner when it is compliant with ISO/IEC 15504-2 requirements and where the assessors collect objective evidence against process indicators to determine capabilities of a process. ISO/IEC 15504 [12] suggests process assessment can be performed either as part of a process improvement activity or as part of a capability determination initiative.

2.3 International Standard for IT Service Management

The ITSM industry has defined a number of processes as best practices in the IT Infrastructure Library (ITIL®) framework. 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 [25]. 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 [11]. ISO/IEC 20000 specifies requirements for IT service providers to develop and improve a service management system [26].

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 [11]. This is valuable for a transparent

method of an ITSM standard compliance audit. The ISO/IEC Standards Working Group responsible for ITSM (ISO/IEC JTC1/SC40) has also defined a PRM for the assessment of ITSM processes as Part 4 of the standard "that represents process elements in terms of purpose and outcomes" [27]. The PRM helps to identify activities required to check and maintain ISO/IEC 20000 compliance. In order to conduct standard-based process assessment, the PRM provides all the indicators to determine process performance at capability level 1 (CL1). The PRM for ITSM is scheduled to be renewed in line with ISO/IEC 330xx family in the coming years [21].

2.4 International Standard for Software Quality Evaluation

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 [13]. Realising the growing adoption 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 [28] describes how the quality models from ISO/IEC 25010 can be used during the evaluation process.

The quality in use is the degree to which software can be used by specific users to meet their needs to achieve goals in terms of effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use [13]. A standard definition of usability is provided in the quality in use model of ISO/IEC 25010, clause 4.2.4 [13]: "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* [13].

3 Overview of the DSR Project

ITSM is an IT management framework that promotes service-oriented best practices to deliver value to organisations. The best practices are transformed into a summary of key requirements and guidelines for process improvement in the ISO/IEC 20000 standard. A major challenges in ITSM process assessment is the lack of transparency in the way ITSM processes are assessed. It has also been reported that existing process assessment methods are costly and time-consuming [29].

Our DSR developed and evaluated the SMPA approach as the research artefact that is proposed to improve ITSM processes in a more transparent and efficient way than the current manual process assessment methods. The project draws on the DSR methodological guidelines for Information Systems (IS) research suggested by Peffers et al. [2]. Figure 1 presents our DSR project methodology.

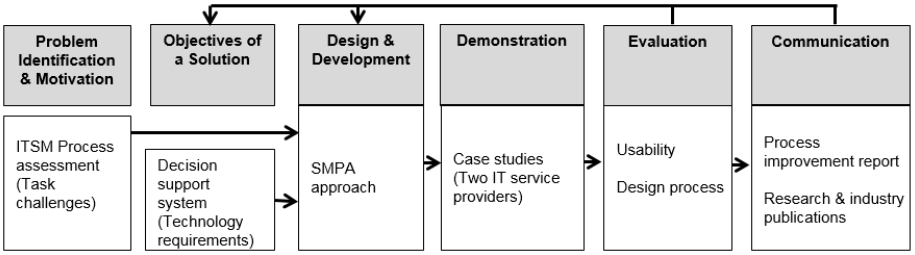

Fig. 1. DSR project methodology (adapted from [2])

The SMPA approach prescribes four phases to conduct ITSM process assessments. The first phase is preparation: information about the organisation profile, processes to assess and assessment participants along with their process roles are captured. The second and third phases survey the process stakeholders according to the ISO/IEC 15504 PAM and then measure process capability based on the survey responses. The final phase generates an assessment report that recommends process improvements for continual service improvement based on the ITIL framework. A comprehensive account of the SMPA approach has been reported previously [30].

The iterative nature of the artefact design process ensured that the final SMPA approach built after several "build-evaluate" cycles has utility and validity. Assessment goals were specified for each of the process capability 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. The SMPA approach addressed transparency issues in ITSM process assessment by following a goal-oriented measurement of ITSM processes using a standard PAM. With the background description of the DSR project, next we describe the artefact design, development and evaluation with reference to International Standards.

4 Artefact Design

In our research, the transparency issue with the ITSM process assessments is addressed with the use of International Standards. Using International Standards, the processes to be assessed are defined as structured activities in the PRM as Part 4 of the ISO/IEC 20000 standard [27]. ISO/IEC 15504 Part 8 was released as the PAM for ITSM [31]. These two International Standards have an interconnecting assessment framework and therefore they provide a transparent model for ITSM process assessments.

The ITSM environment is one where best practices and standards guide processes [11]. Therefore, introduction of a novel method that also conforms to International Standards plays a natural role in the acceptance of the artefact. Based on this premise, the SMPA approach is supported by the International Standards ISO/IEC 20000 and ISO/IEC 15504. Incorporation of widely accepted International Standards also provides justification of the iterative design of the SMPA approach.

Transparency can be demonstrated by aligning the assessment activities with the ISO/IEC 15504 standard that provides guidance on conducting the assessment process [10]. Part 2 of the ISO/IEC 15504 provides a measurement framework with capability

rating metrics [12], however application of the framework to determine process capability is understandably not explicit in the standard. 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 [32]. In cases where a software tool is used (e.g. SPICELite Assessment tool [33] and Appraisal Assistant [34]), the tools provide an interface to record evidence for standard indicators, rate process capabilities and produce assessment reports. There is limited discussion reported on how the collected assessment data is analysed, if it is done so, by any software tools.

Likewise, it is reasonable to assume that proprietary software tools and services in the ITSM industry such as PinkSCAN [35] and ITIL assessment services [36] also report alignment with the standard frameworks (ISO/IEC 15504, ITIL, CMMI) but they are silent about their data analysis approach due to their commercial value. During artefact design, International Standards were used for objective measurement as well as for the generation of the assessment results. The SMPA approach demonstrated transparency with the use of International Standards to not only collect data but also to perform gap analysis and determine process improvement guidelines.

5 Artefact Development

The SMPA approach uses ISO/IEC 15504 standard in order to exemplify a transparent method in ITSM process assessments. According to Part 2 of the standard 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 [12]. The process dimension is provided by an external PRM. Likewise, the capability dimension consists of a measurement framework comprising six process capability levels and their associated process attributes [12]. Process assessment is carried out utilising a conformant PAM that relates to the compliant PRM.

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.

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 [37], there are few studies on the use of the combination for ITSM process assessment using the standard PAM. The standard PAM for ITSM [31] underpins the SMPA approach. Following this PAM, the SMPA approach provides a structured method to conduct process assessment in ITSM.

6 Artefact Evaluation

Artefact evaluation is necessary to confirm the validity of the contributions of the artefact. Evidence of utility of the artefact assures DSR researchers that the contributions of the artefact are applicable. The evaluation strategy advocated by Venable et al. [38] was used for evaluation. 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 using quality factors for use of software.

The SMPA approach was evaluated with focus group discussions of SMPA survey participants and one-on-one interviews with the assessment facilitators at the two IT service providers. In order to assess if the SMPA approach has utility in a real organisation, it was essential to ensure that the survey approach was usable. Therefore, usability was determined as the key evaluation factor. The concept of usability as defined in ISO/IEC 25010 software quality in use model [13] was applied to evaluate five quality factors of the online survey. 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. The data were analysed by reviewing focus group discussions and interview transcripts for themes or patterns related to the five software quality in use characteristics. The use of the International Standard for software quality in use model, ISO/IEC 25010, ensured that consistent terminologies were used during evaluation data collection and analysis.

As per the evaluation outcomes, participants reported that overall they found the online survey for assessment was trustworthy, comfortable and generally effective. Positive comments were also recorded regarding efficiency of conducting online surveys for assessments. However discussions led to a conclusion that a fully automated online survey that is strictly standards-based is not feasible and human input is critical for the facilitation of online assessment surveys. Regarding the use of International Standards, it was found that the PAM and guidelines based on ISO/IEC 15504 provided support to develop the SMPA approach that is more transparent than current ITSM process assessment methods.

7 Discussion

International standards provide requirements and guidelines that can be used consistently to ensure that processes are fit for their purpose. The International Standards referred to in this paper are developed and published on a voluntary but a fully consensus-based approach by independent bodies ISO and IEC that have national representatives of all United Nations member countries. International Standards, by their very nature, are powerful instruments of governance because of the effects their use can have on any activities undertaken. In terms of academic research, while International Standards do not seek to guide any research activity, they can certainly provide valuable support towards the validation of research activities.

There are a number of important parallels between good research practice and good standardization practice. There is tremendous potential to use International Standards

as part of good research practice, for instance, referencing International Standards in literature reviews and using standards to support research actions. Some of the key best practices of International Standards such as openness, transparency, effectiveness, global relevance, consensus and expert opinion [39] relate closely to good research practice. Therefore, researchers can understand and achieve the benefits of using International Standards to support their research activities. Moreover, International Standards embody universally agreed practices, drawing on the experience and expertise of all interested parties internationally. It is therefore plausible to assert that using International Standards promotes good research practice.

The two International Standards ISO/IEC 20000 and ISO/IEC 15504 are secondary data sources that were analysed in depth to extract information as input to develop the SMPA approach. The most relevant documents are the technical report Part 4 of ISO/IEC 20000, i.e. the PRM [27] and Part 8 of ISO/IEC 15504, i.e. an exemplar PAM for ITSM [31]. To the authors' knowledge, few researchers have studied the potential combined use of ISO/ IEC 15504 Part 8 and ISO/IEC 20000 Part 4, e.g. [40]. The choice of ISO/IEC 20000 and ISO/IEC 15504 is reinforced in this research in recognition of the credibility of the International Standards. It is logical to apply International Standard guidelines for evaluation after the experience of using International Standard guidelines for the development of the artefact. The International Standard ISO/IEC 25010 provides a software quality in use model [13] that was used to evaluate the usability of the SMPA approach.

The role of International Standards has been firmly established in greater adoption of ITSM process assessment [41]. For instance, Johnson et al. [42] demonstrated how consistent standards facilitate ITSM with an example of ITIL's configuration management process. Likewise, international IT standards can make the IT service transition less troublesome and help to streamline service operation [9]. 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 [43]. A standard and structured method provides the transparency required to compare outcomes and to measure improvements periodically. In addition, for multinational organisations a standards-based approach grounded on ISO and IEC specifications can make an assessment project feasible to conduct across global regions. The credibility of ISO and IEC is therefore one of the key drivers in this research.

Generally, standards provide statements of good professional practice, such as general principles rather than precise details of activities to be undertaken. Ironically, such an authoritative role of International Standards promotes 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. Nevertheless, since the artefact is scaffolded by the principles of International Standards, the support and validation of the prescribed activities is practical for industry use.

Two significant design issues were faced during the project. First, the process models of the International Standards 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 [27] 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. A comprehensive review of PAM and PRM for ITSM process assessment has been planned within the standards community in the next few years [21].

Secondly, the measurement framework for process assessment is based on the International Standard ISO/IEC 15504-2 [12]. A new framework with updated metrics and assessment concepts is released in the ISO/IEC 33000 family [44]. As new sets of stable process models and standard guidelines are published, it is imperative that the research artefact is updated with changes to questions, calculations of process capability scores and recommendations for process improvement. However, we believe the overall SMPA approach is a valid method and the role of International Standards to ensure its validity remains.

With the expanding significance and reach of the newly published ISO/IEC 33000 standard series, the SMPA approach is expected to be a useful method for process assessments in any discipline that promotes a compliant assessment model. With our research experience in the process assessment and ITSM disciplines, we argue for the genuine contribution from International Standards towards the validity of DSR artefacts. In this light, we propose that International Standards can provide a suitable platform to validate the design, development and evaluation of a DSR artefact.

An overarching principle that governs the application of International Standards for DSR artefact corroboration is that all representations of artefacts (meta-artefacts) must be justified using prior knowledge. We advocate that International Standards are a reliable source of extant knowledge that can justify DSR meta-artefacts. Therefore, we present an application of International Standards from our DSR project, and illustrate its benefits for future DSR studies. Table 1 connects the relevant International Standards to our DSR project and thereby demonstrates how International Standards have justified our DSR initiatives.

Table 1. Mapping of International Standards to our DSR activities

International Standard	Key Role	DSR Activity	Mapping
ISO/IEC 20000	Address problems that the artefact can solve	Artefact Design	Provides a reference model of processes that needs to be assessed
ISO/IEC 15504 – 33000 series	State how the artefact was developed	Artefact Development	Provides the measurement framework and methodological guidance for process assessment
ISO/IEC 25010	Provide proof that the artefact is useful	Artefact Evaluation	Provides a software quality in use model to determine usability, based on ISO/IEC 25010 [13]

The application of International Standards presented in this paper is aimed at promoting DSR transparency to guide researchers to demonstrate valid research work and the utility of research outcomes. It may seem that using International

Standards to validate artefacts could place a burden on DSR researchers whose free-flowing innovation capabilities would be limited. However, we believe that the relevant International Standards can provide a solution to the majority of researchers who are concerned about developing and evaluating a worthy artefact. This resonates with one of the apparent causes of frustration in DSR that claims that DSR outcomes may not be derived from rigorous research work [20]. International standards may address some of the concerns about the quality of artefacts and thereby potentially increase the confidence DSR researchers have in the utility and validity of the final artefact.

Another quality metric that relates to an International Standard's ability to validate artefacts is its ease of demonstration. Once researchers understand the structure of the International Standards, it is our expectation that they will find the standard sufficient and minimalistic to capture all information relating to an artefact that they must validate. For example, in our experience, building an assessment instrument from the ISO/IEC 20000 processes was simpler and more reliable than using the best practice guidelines from ITIL for assessment. Unlike ITIL as best practices for ITSM, ISO/IEC 20000 is minimalistic and tailor-made for assessment with a PRM. While ITSM assessments based on ITIL are certainly possible and more comprehensive, ITIL was designed to suggest improvements rather than assess quality levels. International standards provide a global, consensus-driven set of instruments for corroboration of research efforts, including DSR artefact validation.

In summary, a significant contributing factor to claim generalisation of the SMPA approach is the use of International Standards that provided a consistent structure to conduct process assessments and evaluate results. By developing clearer ways to assess ITSM processes based on International Standards, we hope that our research helps clarify unique challenges in process assessment activities and furthers our understanding of a consistent method to overcome such challenges.

8 Conclusion

Although artefacts represent the major deliverable in DSR projects, very little guidance and examples have been provided on how one can actually validate DSR artefact development and evaluation. This paper discusses the role of International Standards to validate an artefact in a real-life DSR project. The demonstration of this DSR project mapping with International Standards indicates that it is useful to validate artefacts.

From our experience of using International Standards for artefact design, development and evaluation, we believe that artefacts validated using universally-acceptable frameworks such as International Standards can potentially improve the way DSR projects are conducted. Future research can investigate how International Standards have been or could be applied in other DSR projects and whether this can promote validity in the way DSR projects are conducted. Another future research direction could examine previous DSR studies and catalogue International Standards that are used to validate DSR artefacts.

It can be argued that this example is only useful to very limited instances of DSR projects since it reports one artefact validated using three International Standards.

However we argue that any DSR project that needs to validate the artefact can apply relevant International Standards where available and therefore, a more general view should be taken. Although we agree on the broader perspective, our intention for this paper is to give researchers an example of how a DSR project can be corroborated to showcase the validity of the artefact. The 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 International Standards in industry, this research confirms that the standards are useful and supports the transition of new standards for effective industry use.

To conclude, this paper contributes to the IS community because prior work has not adequately addressed the role of International Standards in validating DSR artefacts. We have made a contribution to the growing body of guidelines for DSR with a practical example that demonstrates the role of International standards. The validation of carefully designed research artefacts 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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