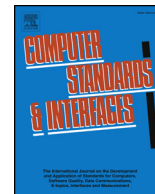




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Benefits and relevance of International Standards in a design science research project for process assessments

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ABSTRACT

One critical challenge in IT Service Management (ITSM) process assessment is the issue of transparency in the way ITSM processes are assessed. A Design Science Research (DSR) project was executed to design, develop and evaluate an artefact in order to conduct software-mediated process assessments in ITSM. International Standards were used to validate the design, development and evaluation of the research artefact in order to demonstrate that the artefact is relevant to practice. Studies relating to the use of International Standards to validate DSR artefacts are scant regardless of broader adoption of the DSR studies and acceptance of the International Standards in practice. DSR studies in particular are required to maintain a balance between research rigor and relevance by reporting artefacts that solve a class of problems based on scientific justification and practical evidence. International Standards provide bodies of knowledge that ensure products, services and processes are of acceptable quality and relevant to practice. Our DSR project confirmed that the external validity of an artefact can be improved with the use of International Standards. Using three International Standards, process assessment ISO/IEC 15504-330xx series, IT Service Management ISO/IEC 20000 series, and System and Software Quality Models from ISO/IEC 25010, this manuscript presents an account of a DSR project with three evaluation sites where the artefact was tested in real organizational contexts. The project demonstrated the significant role of International Standards to confirm research relevance during artefact design, development and evaluation.

1. Introduction

IT Service Management (ITSM) is an IT management framework that promotes service-oriented best practices to deliver value to organizations. The best practices are transformed into a summary of key requirements and guidelines for process improvement. A major challenge in ITSM process assessment is to enable transparent ways in which ITSM processes can be assessed. It has also been reported that existing process assessment methods are costly and time-consuming [1]. We aimed to develop and evaluate a method as a research artefact to measure the capability of ITSM processes in a more transparent and efficient way in comparison with the current process assessment methods.

The Design Science Research (DSR) approach was chosen as DSR is considered appropriate to develop and test a novel artefact [2,3]. While DSR efforts focus on the features and functionalities of the artefact, research work 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 impromptu with merely unconfirmed propositions. Consequently such DSR projects may not be considered as independent scientific research but a typical consultancy project or an arbitrary case study.

One of the key DSR requirements agreed by all schools of thought [4] 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 [5,6], case studies [7] and systematic literature reviews [8] for the corroboration of artefact design, development and evaluation. This manuscript 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 manuscript.

International Standards have been credited with facilitating communication in order to make IT artefacts more consistent [9]. Current technology standardization research in the IT industry primarily investigates the impact of standards on innovation, national economic

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growth and business effectiveness [10]. While ISO standards have been a subject of study in a large number of scientific research projects, the impact of ISO standards has been focused on practices that are associated with the relevant bodies of knowledge. This is not surprising given the aim of International Standards to promote industrial and commercial standards [11] rather than research work. There are a number of statistical, experimental as well as observational metrics of validity that can be used to demonstrate research rigor in quantitative and/or qualitative studies. Scientific studies that need to demonstrate research rigor will not find International Standards applicable to their purpose. However, DSR studies must present a balance between research rigor and relevance [12]. Validity in research relevance is essentially using a quality metric to determine if the research subjects (i.e. artefacts in DSR studies) are closely connected or appropriate for their intended purpose. Research relevance is a significant issue in academic management research [13]. While ISO standards have been extensively used to affirm validity of the research results [10], we believe there are relevant ISO standards that can be used to assert validity towards the *relevance* of the research.

Since International Standards belong to the public domain and are universally applicable for transparent use [14], the role of standards for wider adoption of ITSM process assessments is significant. International IT standards can make the IT service transition less troublesome and help to streamline service operations [14]. We assert that the use of International Standards promotes the validation of DSR artefacts during design, development and evaluation in order to demonstrate research relevance. Our literature review did not find any DSR studies that have used International Standards to demonstrate research relevance. Therefore, we posit that whenever International Standards are applicable and available, DSR researchers should consider their use to promote validity while discussing the relevance of research to practice.

The role of International Standards in artefact validation for research relevance can be demonstrated by its successful application to a real-life DSR project. 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 organization unit's processes against a process assessment model (PAM) [15]. Our research artefact is named the Software-mediated Process Assessment (SMPA) method that enables researchers and practitioners to assess ITSM processes in a transparent and efficient way [16]. The four phases proposed in the SMPA method include (a) process identification; (b) process assessment; (c) process capability measurement; and (d) process improvement.

Three International Standards were implemented during the design, development and evaluation of the SMPA method to ensure that the research outcomes are relevant to practice. The International Standard for ITSM ISO/IEC 20000 series [17] provided the foundation in the form of a process reference model (PRM) for the ITSM processes to be assessed. The International Standards series for process assessment ISO/IEC 15504 [18] provided an assessment model in order to conduct a transparent appraisal of process capability. A decision support system (DSS) was also implemented for the SMPA method to demonstrate automation of process assessments. The software quality in use model in the International Standard for Software Quality Evaluation ISO/IEC 25010 [19] was selected to conduct evaluation of the artefact. Evidence from the evaluation of the artefact at two public-sector IT service providers in Australia indicated that the SMPA method is effective for process assessments [20].

The use of International Standards was a major factor in our DSR project to promote a transparent ITSM process assessment method. In this manuscript, we report details of our DSR project to demonstrate how International Standards supported artefact design, development and evaluation, and thereby present a case for International Standards to be applied by research communities for corroboration of research

relevance. 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 role of the International Standards used. We discuss our research experience highlighting the role that International Standards played in the successful execution of the project and demonstration of research relevance. Finally, we present our conclusions and directions for future work.

2. Literature review

This section presents an overview on the state of the art in DSR studies relating to Information Systems (IS). DSR school of thought promotes the dual importance of rigor and relevance in IS research. International Standards can promote validity in terms of practical relevance of research conducted. The relevant International Standards that were investigated in our DSR project were ISO and IEC standards for process assessment ISO/IEC 15504-330xx series, ITSM standard ISO/IEC 20000 series, and the software quality evaluation standard ISO/IEC 25010. We also present background information about these standards in this section before we discuss their application to our DSR project.

2.1. Design science research

Several DSR authorities have provided critical guidelines that are related to the development and evaluation of artefacts during a DSR project. Baskerville [21] 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 design product (resultant artefact) have to be generalized to a class of problem domains [22]. This position corresponds to the definition of meta-requirements and meta-design provided by Walls et al. [6] in their proposed design theory. March and Smith [23] discussed design science and concluded that research artefacts may be constructed in the form of a construct, method, model, or instantiation. There is a general consensus among DSR researchers that the major contribution of a DSR study should be to develop a design theory or at least some components of a design theory must be presented. With the help of design theories, an artefact can be articulated to solve the identified research problems and therefore confirm the utility of the solution.

Over the past decade, the IS research community has accepted DSR as a rigorous research method. A key requirement in a DSR study is the demonstration of relevance of the research—in particular relevance to practice given the scope of the IS discipline as a practice-oriented discipline. However, being a relatively emerging research method, DSR researches in IS have not presented guidelines to measure and demonstrate research relevance. Given that DSR, akin to its companion evolving method Action Design Research, must aim for practice-inspired research [24], we argue for the use of International Standards in order to validate artefact design, development and evaluation towards relevance to practice.

Gregor and Hevner [25] 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 research relevance which is a major objective of any DSR project [2]. Future DSR studies must demonstrate how proposed solutions can address research problems in order to demonstrate relevance to practice [26]. However, current artefacts reported in DSR studies has been reported to exhibit limited validity in terms of research relevance [27]. Our work is motivated to address this challenge by demonstrating the use of International Standards to validate DSR artefact design,

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