SPECIALIZING A DESIGN SCIENCE RESEARCH METHODOLOGY FOR THE DOMAINS OF IS/IT MANAGEMENT AND IT PROJECT MANAGEMENT

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Research in Progress

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Abstract

This research-in-progress paper presents a research agenda to specialize an initial version of a design science research (DSR) methodology for social systems further for the areas of IS/IT management (ITM) and IT project management (ITPM). The methodology was synthesized based on the current state-of-the-art of DSR in the management discipline and is aimed at designing, instantiating, and evaluating management artefacts. The research agenda to specialize the currently very abstract methodology is divided three phases: 1) substantiating the elements of the methodology further for management artefacts by filling identified research gaps, 2) adapting the abstract methodology to the two domains of ITM and ITPM by reconstructing cases of the introduction of ITM/ITPM artefacts of practice, and 3) application of the substantiated and adapted methodologies to conduct actual DSR and design ITM and ITPM artefacts to solve classes of real-world ITM or ITPM problems. In the end, IS researchers can use the specialized methodology to conduct ITM and ITPM DSR while taking the special nature of organizations and management artefacts into account. Furthermore, the phases of the research agenda can serve as a foundation for further research on how to reduce the level of abstraction of artefacts in a systematic way.

Keywords: Design science, IS/IT management, IT project management, Research methodology, Management artefacts, Artefact instantiation

1 Introduction

Over the last decade, substantial progress has been achieved regarding the theoretical foundations and the methodical support for conducting rigorous and relevant design science research (DSR) in the IS discipline (Gregor and Hevner, 2013; Gregor and Jones, 2007; Hevner et al., 2004; Hevner, 2007; Kuechler and Vaishnavi, 2012; Peffers et al., 2012, 2007). The main focus has been on developing IT artefacts in the sense of Benbasat and Zmud (2003) or Orlikowski and Iacono (2001) or design theories while taking their future application context into account. This covers a well-established core of the IS discipline. However, a previous analysis of ECIS and ICIS conference tracks (Drechsler, 2012) identified two integral areas of the IS discipline which are not concerned with IT artefacts, but organizational or management artefacts: 1) IS/IT management (in short: ITM) and 2) IT project management (in short: ITPM). The former area is concerned with organizational management systems for the management of information systems and technology, while the latter area covers the management of (usually temporary) project organizations to develop new IT artefacts.

In contrast to information technology, organizations are of a special nature which includes, for example, phenomena such as informal structures, unpredictability, surprises, and emergence (Tranfield et al., 2006). Therefore, it stands to reason that IS DSR to develop ITM or ITPM artefacts needs to employ at least somewhat different approaches and methods compared to IS DSR with a more technical focus on the IT artefact. In fact, such a call has been made in several publications (Kuechler and Vaishnavi, 2008; McKay and Marshall, 2007), but, again, mainly with a focus on improving IS DSR for IT artefacts and not for management artefacts. Carlsson (2007, 2010) is an exception here, but he is less concerned with developing abstract management artefacts but focuses on designing "IS interventions" instead. Overall, the current state-of-the-art of IS research is still lacking in over-arching procedural and methodical guidance for researchers willing to engage in designing ITM or ITPM artefacts (or design theories). There are also few, if any, actual designs and evaluations of such ITM and ITPM artefacts to be found in the literature.

As a contribution towards remedying this issue, a comprehensive DSR methodology for the design of social systems was proposed (Drechsler, 2013), based on the current state-of-the-art of DSR in the management disciplines. However, viewed as a design artefact, the methodology in its current state constitutes an artefact of a very abstract level, since it lacks concrete methodical or domain-specific guidance. Its actual utility to conduct meaningful DSR in actual ITM and ITPM DSR projects has not been evaluated yet either. Therefore, it is – in the words of Nicolai and Seidl (2010) – currently only of conceptual relevance for IS researchers (since it can inspire them and thus has potential utility for enhancing future DSR efforts) but not of instrumental relevance (since it cannot be directly applied to an IS DSR effort due to a too high level of abstraction).

Interestingly, there is only very little guidance to be found in the literature, on how to instantiate and adapt abstract artefacts to specific application contexts, in order to preserve or convert the potential utility of an abstract artefact into actual utility on the instance level. For example, Gregor and Jones (2007) regard "principles of implementation" only as an additional and not a core component of design theories and only refer to examples on the instance level with little attempts for generalization. Tranfield et al. (2006) even characterize this instantiation process to be more an art than science. This is an unsatisfying state, given the regular necessity of the instantiation of abstract artefacts so that they can provide actual utility on the instance level, at the least during their validation in a DSR project.

In this light, the goal of this research-in-progress paper is to present a research agenda for specializing and tailoring the aforementioned DSR methodology artefact to the two application domains of ITM and ITPM. The objective is to increase its actual utility – and thus, instrumental relevance – for IS researchers by deliberately reducing its level of abstraction to provide specific guidance for DSR for ITM and ITPM organizations. At the same time, the level of abstraction is not reduced to specific instances, but only to typical classes of ITM and ITPM organizations. Therefore, the term specialization instead of instantiation is used for this reduction of abstraction since no actual real-world application on the instance level is intended in the current scope. Specifically, the intention of the research agenda presented in this paper is to point out areas where such a specialization has the potential to increase the actual utility of the methodology for IS researchers, but where further research is required to realize it fully (such as concrete methodical or domain-specific guidance). The research process to achieve this increase of utility through specialization is going to be structured in phases (see section 3). Since there currently is a lack of guidance on how to reduce the level of abstraction for artefacts in a rigorous – or at least guided – way, these phases can serve as a first proposal for such a generic artefact specialization (or instantiation) process that goes beyond "art". In this context, the future execution of the research agenda serves as an initial evaluation of the validity of these phases.

In the remainder of the paper, the DSR methodology for social systems is briefly described at first. Afterwards, three phases for specializing this methodology artefact are derived and, for each phase, future research activities with the intention to increase the actual utility of the DSR methodology are discussed. In the end, a brief conclusion is drawn and an outlook towards future research is given.

2 Overview of the methodology artefact

The proposed DSR methodology for social systems is based on the works of van Aken et al. (Denyer et al., 2008; Tranfield et al., 2006; van Aken and Romme, 2012; van Aken, 2004, 2005, 2007) and represents the current state-of-the-art of DSR in the management discipline, condensed into an overarching DSR process (Drechsler, 2013). It was found to be generally compatible to the current state of DSR in the IS discipline (as summarized by Gregor and Hevner (2013), for example), but differs in several aspects, in order to take the special nature of organizations into account. It aims to solve real-world problems by producing designs (artefacts) of a possible future organizational reality. The theoretical inputs can consist of explanatory results from empirical research and/or derived design knowledge – for example, in form of technological design rules. Two key abstract artefacts are specified as outcome of DSR processes: 1) an object design specifying a "blueprint" for a possible future organizational reality of IT organizations and 2) an implementation design which specifies a "blueprint" for the change management effort to implement the object design into a specific application context. During such an implementation, both the object design and the implementation design are to be instantiated in a context-specific way and tailored to the target organization in question. More specifically, the implementation design prescribes three distinct steps for the instantiation and adaptation of the abstract object design: two redesigns and a final phase of learning to perform. In the first redesign, the initial adaptation of the abstract artefact for its future application context is to be conducted. The second redesign involves further adaptation and the actual integration into the target organization, this time involving the future artefact end-users. After the conclusion of the implementation effort, a thorough evaluation is to take place, allowing the validation or refinement of both abstract artefacts as well their theoretical foundations. The overall goal is to build and refine a field-tested "body of knowledge" of theoretically grounded and empirically-validated artefacts and accompanying design knowledge. In addition, the process of artefact instantiation is not viewed as engineering-like "installation" of the instantiated and tailored object design, but as triggering a path-dependent or even path-creating change process in the target organization. Beyond these high-level process steps, no further methodical or domain-specific guidance is given as part of the methodology.

3 Research agenda for specializing the methodology artefact

As stated in the introduction, there is currently no specific guidance available how to reduce the level of abstraction of an abstract artefact and tailor it to a specific application context. Interestingly, the two phases of redesign and the final phase of learning to perform of the implementation design as part of the methodology itself come closest. The methodology covers artefacts which specify possible future organizational realities of social systems. At the same time, it can be classified as a research artefact, which – in a wide interpretation – also constitutes a social artefact. Therefore, applicability on an abstract level can be argued. The goal of the implementation design also matches the goal of this research agenda, providing specific steps on how to reduce the level of abstraction of an abstract artefact for its application a specific application context (in this case, DSR for the domains of ITM and ITPM). Therefore, in the absence of more specific guidance, the basic structure of the two redesign phases and the final phase of learning to perform is applied to the structure of this research agenda as well. This leads to dividing the proposed research agenda for the specialization of the methodology in three phases, each contributing in a different way to the overall goal of reducing its level of abstraction and increasing its utility for IS researchers as shown below.

According to the methodology, the *first* redesign phase is aimed at preparing the abstract artefact for its future application context, but without taking specific aspects on the instance level into account. Applied to the goal of specializing the methodology, this means reducing the level of abstraction by *substantiating* its abstract elements for the general application context of management, which includes

the more specific domains of ITM and ITPM (which are regarded as equivalents to the "instance level" and are thus not covered specifically). The idea of this first phase is to provide a theoretical foundation along with an ample methodical "toolbox" for management DSR for each element of the methodology without becoming specific to any management domain such as ITM or ITPM.

The goal of the *second* redesign phase is to further adapt the abstract artefact, this time specifically for the future application context(s). Applied to the overall goal of specializing the methodology, this means reducing the level of abstraction further and *adapting* it the two intended application domains: ITM and ITPM. This includes adding, changing, or even removing elements of the methodology. The target organization types of the two domains have very different characteristics: the former one is aimed at stability, repeatability, and efficiency while the latter one is of temporary nature and designed to cope with novel problems and change. Therefore, it is at least conceivable that an application in the two domains needs different elements or emphases of the methodology. Here, it is of note that there is no discussion about different domains of application and their implications in the management DSR literature the methodology is derived from, highlighting the need for this step even further.

The *third* phase of the implementation design is called "learning to perform". This implies that the artefact is part of application context and the artefact end users are to learn how to use it effectively and efficiently. For the goal of specializing the methodology, this means to actually *apply* the substantiated and adapted to real-world ITM or ITPM problems – or in other words the design and evaluation of novel abstract ITM or ITPM artefacts by using the respective adapted methodologies resulting out of the second phase. Pries-Heje et al. (2008) call a real-world application the real "proof of the pudding". In the case at hand, it allows to evaluate the actual of utility the previous substantiations and adaptations brought for enhancing the quality of the DSR process and the corresponding DSR products to solve real-world classes of ITM and ITPM problems.

In the subsequent sections, the research agenda for each of the three phases is detailed further. It is of note that, due to the still high level of abstraction and the application context of a research artefact, it is not possible to provide specific metrics or criteria for the elements of this research agenda within the space available.

3.1 Phase 1: Substantiation of elements of the methodology artefact

As outlined above, the goal of this phase is means to fill in any remaining "blank spots" regarding theoretical or methodical aspects for each of the elements of the methodology as outlined in the second section. Here, research gaps can exist because of gaps in the management DSR literature the methodology stems from, because of theoretical foundations or IS DSR methods that do not fit in the application context of management DSR and artefacts, or because of gaps in the IS DSR literature in general. Subsequently, for each element (or combination of elements) of the methodology a brief outline of research gaps and accompanying research agenda is given.

Linking explanatory theories, design knowledge, and management artefacts. On an abstract level, there is already a certain body of knowledge in the IS DSR literature for the first three steps and the link between them. Gregor and Jones (2007) regard design principles and justificatory knowledge crucial elements of design theories which also encompass abstract artefacts. Kuechler und Vaishnavi (2012) propose the introduction of a specific intermediate step between explanatory and design theories that function as formal link: "design-relevant explanatory and predictive theories" (DREPT). Fettke et al. (2010) call this intermediate step between explanatory theories and design artefacts "design knowledge". The management literature proposes so-called CIMO design rules (Context-Intervention-Mechanism-Outcome) as instrument to specify design knowledge in a semi-structured way (Denyer et al., 2008). Carlsson (2007, 2010) proposes an extension and application of this concept to IS DSR. However, neither Denyer et al. nor Carlsson have an artefact focus. Therefore, future research here needs to evaluate the suitability of the CIMO concept for specifying design

knowledge for artefact-centric management DSR and provide concrete methodical support how a transformation of explanatory findings to design knowledge to elements of management artefacts can take shape.

Nature of management artefacts. The nature of IT artefacts is well established in IS DSR: constructs, methods, models, instantiations (March and Smith, 1995). In contrast, there is little to find in the management DSR literature about the nature of management artefacts. Romme speaks of them as "tangible or intangible social facts" and gives the following example: "products, services, organizational structures, organizational identities, business strategies, multiuser networks, management tools, projects, and discourses" (Romme, 2011). This broad definition appears of little use during a management DSR process. Further research to propose constituent elements of management artefacts can draw on socio-technical research (Bostrom et al., 2009) or Alter's work on "work systems" (Alter, 2013), for example, and relate their concepts to elements from existing and successful management artefacts of practice.

Modelling management artefacts and future organizational reality. The management DSR literature does not explicitly discuss the issue of the language to use to specify the artefacts. But in order to be able to model an object design representing a possible future organizational reality in a rigorous way, more formal ways of specification should be applied than potentially ambiguous natural language. The models should also provide a formal link (and hence, traceability) to the underlying design knowledge. Here, approaches from enterprise modelling appear suitable to be employed and adapted, for example the MEMO language (Frank, 2002). There is also a first outline of a modelling language specifically aimed at the area of ITM (Frank et al., 2009), showing a way of domain-specific modelling languages. However, these modelling languages have neither been evaluated in detail regarding their suitability for this task nor were they being applied in actual management DSR projects. Further research here can contribute ways how management artefacts can be specified in more sophisticated ways than with natural language and simple diagrams and how artefact elements can be traced back to theory.

Role of designers / link to action design research. Venkatesh (2008) regards the IS DSR discourse as generally "under-socialized" and sees the designer of a social system – such as IT or project organizations – as an agent. As a result of this agency issue, designers might further their own interests through the design, instead of pursuing organization-related goals. These may range "from competitive and managerialist concerns through workplace democracy and human relations" (Alter, 2010). In the context of the methodology, it is important to differentiate between researchers as designers of abstract artefacts and practitioners who decide whether and how they are going to be redesigned and instantiated in their IT or project organization. In the management discipline, Kieser and Leiner (2009) regard the chasm between researchers and practitioners as "unbridgeable". In contrast, other authors regard design science as especially suited to bridge this gap (Hodgkinson and Rousseau, 2009) or emphasize the need of artefacts to inspire (Avenier, 2010). Neither source provides concrete methodical support, however. In the IS discipline, action design research is proposed as one specific research approach to bridge this gap (Sein et al., 2011). However, their approach is specifically tailored to IT artefacts. An adaptation of their approach to management research can potentially show one possible way to effectively bridge the gap between research and practice in artefact-centric management DSR. To ease an application of the methodology to real-world management problems, it is an avenue for further research to give a clearer picture of possible roles and responsibilities of all possible stakeholders involved – on both the abstract and instance level – and give concrete recommendations based on such an analysis as well as practical experiences from actual cases.

Context-specific redesign and instantiation of management artefacts. In order to satisfy the criterion of abstraction for research (Frank, 2006), DSR emphasizes the design of abstract artefacts or design theories which are aimed at solving classes of real-world problems. An application to a specific context thus means the need for artefact instantiation. However, as mentioned above, there is

surprisingly little attention being paid to the process of instantiation or context-specific artefact redesign in the IS DSR literature. Gregor and Jones (2007) recognize mutability as one element of an IS design theory. Gill and Hevner (2013) propose to emphasize fitness along with the traditional criterion of utility for artefact design. Due to the unique and unpredictable nature of organizations as stated above, artefact mutability and fitness play a special role for abstract management artefacts so that they can actually deliver their potential utility. Further research in this context can inform DSR theory how successful management artefacts of practice deal with the issues of mutability and fitness and develop guidelines how to design abstract management artefacts to incorporate these aspects. This includes a greater formalization of the interplay between the object design and the accompanying implementation design as part of the methodology. Also, the role of other elements of design theories beyond the abstract artefact – such as testable propositions and justificatory knowledge – to guide the redesign and instantiation process of an abstract management artefact needs to be examined further.

Integration of instantiated management artefacts into existing organizations. Another aspect which is under-emphasized in the current DSR literature is the process of integration of instantiated artefacts into existing structures, processes, and systems – or in other words: When does an artefact stop being a separable entity but becomes an indistinguishable part of its application context? For IT artefacts, socio-materiality (Leonardi and Barley, 2008; Orlikowski and Scott, 2008) may provide some answers, but the concept is only of limited use when management artefacts are in the focus of interest. Another commonly used theory on the IS discipline to draw on when exploring this aspect is the diffusion of innovations theory (Rogers, 2003). To the authors' knowledge it has not yet been applied to the process of the introduction of management artefacts in organizations. In the management literature, Romme (2011) speaks of an "artifaction process" instead, consisting of four modes: fabrication, displacement, reinterpretation, and ascription. This specific perspective also provides a link back to a previous issue: Different understandings of the nature of artefacts lead to different understandings and perspectives of this adoption and integration process. Goals for further research in the context of the proposed methodology include understanding the adoption process of management artefacts in greater detail and deriving design knowledge to inform future design efforts.

Management artefact success and forms of utility. Due to the number of different artefacts in the methodology (object and implementation design, abstract artefacts and instantiation), it is currently a challenge to measure artefact success and their utility clearly. Any success or failure of a design effort can be attributed to the (in)adequacy of the abstract object design, the abstract implementation design, their instantiations in practice, and/or the underlying goals for the whole effort. In addition, the clear delineation of abstract artefacts (in the realm of research) and their instantiations (in the realm of practice) leads to the need to distinguish between two forms of utility. In the management literature, Nicolai and Seidl (2010) differentiate between three forms of relevance for research outcomes: conceptual relevance (to inspire and guide decisions), instrumental relevance (to be readily applicable in practice), and legitimative relevance. For DSR artefacts, this means that abstract artefacts need to be evaluated in terms of their conceptual relevance (or, in other words, their potential utility which, in turn, is influenced by their fitness to be mutable to fit to a specific context) while instantiated artefacts are to be evaluated in terms of their instrumental relevance (or actual utility). Here, further research concerning the different types of relevance, their application to abstract and instantiated artefacts, and the "inspirational power" of abstract management artefacts for practitioners is needed.

Link from management artefact evaluation back to design knowledge. Current IS DSR evaluation methods focus on evaluating IT artefacts (Peffers et al., 2012). While some or even all of them may be of utility for the evaluation of management artefacts, their specific suitability needs to be evaluated in greater detail in further research. Such an analysis needs to consider the number of different artefacts as part of the methodology, the aforementioned challenges to attribute success, as well as the different criteria of actual utility (for instantiated artefacts) and potential utility, "inspirational power", and fitness (for abstract artefacts) mentioned before. In addition, following the elements of the methodology, an evaluation is not supposed to solely focus on artefacts, but also to validate or refine

underlying design knowledge. Here, Pawson and Tilley (1997) propose a general strategy evaluating "CMO configurations" (which are related to CIMO design rules mentioned above) with regard to their effectiveness in practical application, but it is not artefact related. The task for future research here is to develop a set of adequate evaluation methods to address the issues raised above and to analyse whether and how existing evaluation methods can be modified to meet these requirements.

3.2 Phase 2: Domain-specific adaptation of the methodology artefact

The goal of this phase is to adapt the substantiated methodology for management DSR for the two application domains of interest in the IS research context as identified in the introduction: IS/IT management and project management. In the end, this will lead on a further reduced level of abstraction. At the same time, both methodologies adapted to their respective domains are going to retain a certain level of abstraction so that they are still applicable to classes of real-world ITM or ITPM problems, respectively, and have, at the same time, a higher utility for IS researchers.

One way to achieve such an adaptation would be to use the methodology to guide concrete DSR projects in the two domains, in order to discover necessary or useful additions or changes to the methodology as well as elements which are of no utility. However, such an approach, based on the current state of the methodology, is problematic. It would mean to use a (potentially still too) abstract and unproven methodology to design at least two more novel abstract artefacts (object & implementation design, see section 2) for each of the two domains and instantiate them in several real-world application contexts. Here, a major challenge would be to attribute success or failure in the respective DSR efforts clearly to the methodology or to the artefacts designed and instantiated in the process. On the other hand, adapting the methodology without a real-world perspective would be guesswork at best. Ideally, the methodology adaptation could take place with existing validated artefacts that resulted out of its application, so that the evaluation could focus on adapting the elements of the methodology itself. This, however, leads to a "chicken and egg" problem, since the methodology has not been applied before, and therefore no ITM/ITPM artefacts exist yet that were developed on its basis. Due to the lack of documented applications of management DSR in the respective body of literature, it is also not possible to use management artefacts from other domains.

As a solution for this dilemma, it is proposed to reconstruct past introductions of established management artefacts of practice in the two domains in form of case studies. For the different areas of IT management, candidates for such artefacts of practice include the ITIL framework for IT service management (TSO, 2011) or COBIT (ISACA, 2012) for IT governance. Likewise, for the IT project management domain, successful artefacts of practice include the PRINCE2 framework (OGC, 2009) or Scrum (Schwaber, 2009). Applying Yin's case research framework (Yin, 2009), the elements of the methodology form the theoretical framework to guide the case research. The idea is to structure the artefact introduction process in the each of the cases and map the structural elements onto the elements of methodology. Any process steps or elements of the reconstructed cases which are not represented in the methodology lead to elements which are candidates for addition, if they can be found across cases. Elements which can be reconstructed (or successfully substituted) across several cases are deemed to be useful and elements which do not contribute either way are candidates for removal. The substitution covers the issue that the aforementioned artefacts of practice tend to lack a theoretical foundation.

When selecting parts of the artefacts of practice (for example, ITIL processes) for the case reconstruction, they need to be of a sufficiently complex nature so that it can be demonstrated that the methodology is adequate for coping with the necessities of handling even complex object designs. The contexts of the cases should also be of a high heterogeneity and variety, representing a typical spectrum (Gläser and Laudel, 2010) of ITM or ITPM organizations, in order to account for the variety of real-world organizations. An additional strength of this approach is to highlight the practical relevance and applicability of the methodology by showing that several of its elements may already be applied in practice. It also allows providing a first substantiation of new or changed elements, even if

such substantiation is at first only based on practical knowledge and lacks a theoretical foundation. The development of such theoretical foundations for added or substantially changed elements forms the final part of this phase. Based on the differences between the cases across the two domains, it is possible that a single adapted methodology emerges (in case the aforementioned differences of IT and project organizations do not make a difference when introducing artefacts), or that two specific methodologies emerge for the two domains which have the same root, but differ in specific elements.

3.3 Phase 3: Application to real-world ITM and ITPM problems

After the substantiation and adaptation phases, the final step to specialize the (now possibly two) methodologies are their first applications to solve real-world ITM and ITPM classes of problems. Of the starting points suggested by Peffers et al. (2007), either a problem- or objective-centred initiation of a DSR effort appears to be the most suitable. Here, it is important that the problem or objective is of interest for several IT organizations or IT project situations to have a suitable number of varying application contexts for the abstract artefacts. The eventual application needs to consist of a thorough application of the respective specialized methodologies, a well-justified choice of state-of-the-art IS DSR methods in each step, as well as a thorough evaluation of each step and the respective methods applied regarding their effectiveness and possible room for improvement. This phase serves to demonstrate and improve the actual, instrumental utility of the specialized methodologies for conducting ITM and ITPM DSR as well as the substantiations that took place in the first phase.

4 Conclusion and future work

This research-in-progress paper provided a research agenda for the specialization of an abstract design science research methodology for social systems (Drechsler, 2013) for the two domains of IT management and IT project management. Specialization means the structured reduction of its abstraction by adding theoretical and methodical support as well as domain-specific guidance and thus, increasing its utility for IS researchers. Based on the three steps of the implementation design as part of the methodology, the specialization process was divided in three phases: 1) the substantiation of the elements of the methodology for management artefacts in general, 2) the adaptation of the methodology for the two domains of ITM and ITPM, and 3) the application of the adapted methodologies in actual ITM and ITPM DSR projects. In a wider perspective, it was argued that these three phases can serve as generalized phases for the structured or guided reduction of abstraction for abstract DSR artefacts, an area where currently only little guidance is available in the literature. As next step, the author intends to proceed with closing the research gaps identified in phase 1.

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