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Authors	Pirkkalainen, Henri
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Dealing With Emergent Design Science Research Projects in IS

Henri Pirkkalainen

University of Jyväskylä, Finland
{henri.j.pirkkalainen}@jyu.fi

Abstract. Multiple models, methods and frameworks have been proposed to guide Design Science Research (DSR) application to address relevant classes of problems in Information Systems (IS) discipline. While much of the ambiguity around the research paradigm has been removed, only the surface has been scratched on DSR efforts where researcher takes an active role in organizational and industrial engagement to solve a specific problem and generalize the solution to a class of problems. Such DSR projects can have a significant impact on practice, link theories to real contexts and extend the scope of DSR. Considering these multiform settings, the implications to theorizing nor the crucial role of researcher in the interplay of DSR and IS projects have not been properly addressed. The emergent nature of such projects needs to be further investigated to reach such contributions for both theory and practice. This paper raises multiple theoretical, organizational and managerial considerations for a meta-level monitoring model for emergent DSR projects.

Keywords. Design Science Research, Emergent Settings, Research Projects, Information Systems

1 Introduction

The ways of incorporating Design Science Research (DSR) in solving practical organizational and design-oriented problems continues to raise discussion. DSR can result in variety of design artifacts ranging from implemented systems and services to DSR methods, constructs and organizational support structures, e.g. business models [1], [2]. The basic activity of DSR has been repeatedly seen to consist of build and evaluate –activities where design solutions are proposed and addressed as a solution to overcome persistent real-world challenges [3], [4]. Despite the iterative nature of DSR [5], [6] and the direct relation to organizational challenges, a majority of DSR studies include retrospective evaluations of existing implementations [7]. In principle, DSR is not just evaluation of an existing component [3], [7]. It is an approach for developing ways of understanding and working with technical systems and to questioning existing structures and processes [2]. As emphasized by Avison et al. [8], researchers should study and apply their theories in practice.

The implementation of full DSR cycles in design and development efforts can be very time consuming and vulnerable to not succeed [9], [3]. From this perspective it is

no wonder DSR projects that are initiated and carried out in an organizational context have not been as prominent in DSR. As argued by Iivari [9], DSR research lacks evidence how to successfully plan and conduct DSR research efforts in organizational collaboration.

The connection of DSR and Action Research (AR)-method has been proposed and implemented previously by Sein et al. [5] and Markus et al., [10]. DSR projects that incorporate the organizational cooperation between researcher(s) and a client organization are emergent in nature [9], [10], [5]. Such projects have to deal with many uncertainties as they evolve through common contracts to the implementation and evaluation of the created artifact in real-life contexts [5], [11]. Projects can be seen as temporary organizations that are created to fulfill a special purpose and exist only a limited time [12]. While no information exists to the author's best knowledge on the failed emergent DSR projects, the harsh reality is that up to 70% of IS-projects fail to reach their goals [13].

Apart from distinguishing the type of client-initiated DSR that shares similarities to AR [14], [5], [9], and presenting a method to run such as Action Design Research [6], proper guidance and evidence is lacking how to deal with the emergent nature; rapid changes in the market and within IS-projects and organizations where DSR is addressed. What is not addressed in DSR research is 1) the role of the researcher in the interplay of the DSR- and the IS- project, 2) the types of IS-projects that are favorable to DSR, 3) how to address theorizing and DSR artifact building and evaluation in such emergent environments.

Based on the lessons learnt from 3 case studies, this article extends and challenges the current understandings of emergent DSR projects, presenting considerations towards a meta-level monitoring model METADSR to emergent DSR projects. The model explains how DSR researcher can monitor and deal with fundamental challenges of emergent DSR.

2 Operating DSR Efforts in Collaborative Research Projects

Multifold organizational and management theories have been discussed over the past years to explain organizational development, and the organization of tasks and activities in a form of projects. IS-projects often are interdisciplinary in nature, bringing together researchers and practitioners from both academia and companies [10], [9]. An underestimated or even neglected aspect in emergent DSR is the *organizational and managerial side* of such research projects. Commonly in DSR articles only the results of research efforts are reported. Therefore the organizational boundaries and the ways of dealing with compromises and contextual disruptors are not considered within. While many DSR projects implemented into organizational context have been initiated with the design artifact as the expected solution of the project, the reality is that the *DSR activity drives the projects only on a handful of cases*.

IS-projects are *vulnerable to many types of internal and external factors* that make them unexpected and vulnerable to changes. As emphasized for contingency

theory, the organization of work and the processes cannot be optimized in a way that it would be effective in any situation [15]. The optimal solution has to comply with various internal project and its organization specific as well as external contextual and domain specific constraints [15]. Similarly, the *emergent nature of systems design* is bound to the context where its being planned, designed and deployed [16].

Within project management research, Shenhar and Dvir [17] as well as Brocke and Lippe [18] have been discussing the types of development as well as Research and Development (R&D)-oriented projects from industrial as well as from public funding perspectives. Each of the types of options has several managerial and organizational challenges when it comes to running a successful collaborative project [18]. An unexpressed form of DSR lies in addressing the class of problems in multiple real-life projects [9]. In this study, the alignment of the DSR activities between 3 separate IS-projects demonstrates this approach.

3 Case Descriptions and Methodology

Between 2009 and 2015, three IS-projects were executed to design and develop service-oriented architectures to enable the integration of educational technologies to support virtual communities of educators and researchers. Within these IS-projects, DSR projects were embedded to study the IT use of educators as well as behaviors and attitudes on exchanging knowledge beyond their local context. Each project was 1) interdisciplinary, 2) consisted of project teams ranging from 6 to 50 organizations, including companies and research institutions, 3) was public funded, 4) Research was either supported or the DSR artifact was embedded in to a development-project. The projects were operating in similar domain area but not fully depending on each other. The DSR efforts and their alignment to several IS-projects was planned and implemented by the researcher.

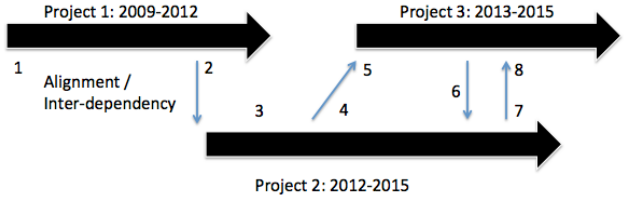

Fig. 1. Timing of the IS projects and the alignment of the DSR activities

The DSR activity/process was aligned as follows within the cases (IS-projects):

1. The problem and objectives set. Class of problem defined for critical disruptors for contributing in virtual communities for education. Objectives set for the IS-project for development of distributed services and the behavioral study to inform a design theory on knowledge exchange disruptor management. Implementation of the DSR cycle not successful; contradicting emergent aims of the DSR and the IS-project.

2. Negotiation of the DSR focus to a new IS-project, embedding detailed plan. Refining the research approach to allow adaptation on the way.
3. Refining objectives through contextualization to IS-project focus.
4. Initial definition and implementation of both meta-requirements and running system of integrated services to support virtual communities in education. Evaluation and refinement of the focus. Identification of problems to reach DSR objectives within the project.
5. Negotiation of the DSR focus to a new IS-project, embedding detailed plan with class of problems divided to enable comparative study and investigation on emotional and behavioral factors.
6. Merging evaluation activities within two IS-projects. Comparative study.
7. Further analysis within project 2 leads to refinement of the theory and need to adapt theoretical model and refine objectives.
8. Negotiation of refined evaluation objectives and changing project plan to support the adapted process.

This article does not intend to brief on the objectives and results of each DSR effort embedded to the IS-projects. The remainder of the article highlights critical issues on emergent DSR-projects that are not reflected within previous research articles in detail. These considerations are refined through the lessons learnt within the three cases, proposing a new METADSR model that allows meta-level monitoring and alignment of emergent DSR efforts in IS-projects.

4 Considerations for Monitoring Emergent DSR Projects

Reflecting on the theoretical background and the cases included in this study, the following types of IS projects will be differentiated and discussed from emergent DSR project- perspective: **1) Collaborative R&D projects** that either are industry or public funded; are either national or international; most likely interdisciplinary; involve both academia and companies **2) Development or network oriented projects** where research is not funded; including similar criteria as above, and **3) Array projects**; the types of comparative or longitudinal DS research projects that are linked to multiple IS projects.

Various considerations should be given to designing DSR projects in close collaboration with researchers, practitioners and industries. While lessons learnt in the three case studies guide the section, the considerations from managerial perspective are extended from the work of Shenhar and Dvir [17] and Brocke and Lippe [18] in terms of operational and interdisciplinary matters. Critical aspects for DSR come from the role of theorizing and emergent role of DSR as discussed by Lee et al. [19], Sein et al. [5] and Peffers et al. [14].

Table 1 presents some of the key considerations and extends the discussion for each of these on related critical issues that need to be monitored and dealt with.

Issue 1 – Contract and planning: No matter which type of organizations are involved in IS-projects from the industry and academia, *a form of contract* is written between the parties. Embedding DSR activities and the responsible researcher(s) to such contract is vital, no matter if deviations of work would occur during the IS project. The projects that are in the planning stage generally apply high-level decision-making, leaving room for fine-grained, low-level decision-making to take place during IS projects. The challenge for DSR is to continuously be alert when tasks and activities are discussed that can affect the research process, leading to **Issue 2 – Decision making**. In many cases, such *decision-making processes are out of reach for a researcher*. It is crucial to identify the key actors in the network during negotiation and planning. The critical issue still remains on the actual *stakeholders who will be handling the daily work* within IS projects.

Table 1. Key considerations for the implemented DSR activities embedded to IS-projects

	Collaborative R&D project (case 1&2)	**Development projects (case 3)**	**Array Projects (between cases)**
DSR embedding to project	As a separate mission outside the contract (case1). DSR process defined (case 1 and 2)	Cut-down class or problem addressed. Partial DSR study aligned to objectives	DSR cycles not matched, activities cut based on the context and project
Stakeholders /decision making	Interdisciplinary, DSR concepts not embedded (case1) – no leverage in emergent DSR	DSR concepts and constructs embedded. Context allowing separate goals from IS-project	Implications from one case to all others. Constant alert and awareness needed
Role of theory	Theory development, emergence allowed but not fully supported by the project (case1)	Theory refinement. Separate language and communication in DSR and in IS project	Theory formed, refined and tested through several projects.
Role of intervention	Technical and organizational interventions disconnected from DSR artifact (Case1) – leading DSR away from IS-project	Org. Intervention matched to DSR artifact while additional evaluation activities addressed beyond the scope of the project	Intervention and theory aligned throughout the process of planning new IS-projects. Not all objectives link to DSR

Issue 3 – DSR linkage to the IS-project: One of the biggest challenges for DSR is when technological uncertainty is high and project is at risk to fail, how to ensure and to some extent separate the DSR project from the IS-project. If the DSR artifact is a key component of the IS-project, the DSR success is fully tied to the IS-project. However, the higher the risk, the better the changes for multifold data collection and workforce to support the research activity. Such was attempted in cases 1 and 2 but

only succeeding in the latter. Therefore, the key success factor and the objective to monitor is that the *DSR artifact needs to be linked to the implementation of the IS project while not being fully tied to either the success or failure of the project*.

Issue 4 – Over optimism: A major challenge that was faced in each of the cases was that the preparation phase that links the DSR activities to a larger IS-project is likely to be more optimistic than the achievement of the project activities in reality. The occurring internal or external factors are persistent and cause deviations that need constant monitoring. **Issue 5 – Evaluation:** In-depth evaluations can be challenging to accomplish in development projects if partners require closed settings. In emergent DSR efforts, researcher is depending on the commitment and cooperation of other stakeholders. Within cases 1 and 2 the concepts relating to the DSR artifact and its objectives were embedded to the contract of the IS-project, which enabled a strong leverage when discussing priorities for both development and evaluation. This was needed for large IS-projects with multiple research institutions sharing the evaluation responsibilities and cooperating on the tasks. Biggest challenge from operational side is in development projects where the research activities are not in focus and the researcher must ensure ways to evaluate the artifact outside the scope or without the supports of the IS-project.

Issue 6 – Role of intervention: Commonly in IS-projects as for AR in general, an intervention or a set of interventions are defined, implemented and evaluated in organizational context. The *critical factor for DSR is whether the design artifact studied is also the intervention or a major component of it*. Regardless if it's a physical implementation, a method or an organizational support instrument.

Issue 7 – Theorizing: *design theorizing and theorizing is likely not to follow a certain pattern* but can emerge through grounded rigid steps or through reflection and emergence from the data [19], [6]. Key questions for DSR have been whether theory informs DSR activities, or should the activities develop or refine the theory [6]. One of the major challenge for successful implementation of DSR is IS-projects is *whether the key concepts of the upcoming design theory or artifact are embedded to the core of the IS-project*. Concepts are in the center of grounded theorizing [20] but also set boundaries to the investigation to be handled within the IS-project by a clear explanation – what are we studying.

Issue 8 – Unexpected re-alignment: As emphasized for AR, there needs to be room for theory refinement through iterative work [21]. When new phenomenon or user behavior is detected that causes a need to refine the approach, negotiation processes are set in place and much is depending on the *competences of the researcher* in charge of DSR to explain and argue why the new constructs, concepts and refined focus have to be implemented within the IS-project. On one hand only individuals with great influence or a management position can ensure the continuation and success of the DSR project. On the other hand, iterative build-evaluate activities and refinement of the DSR process are necessary in such situations. Such changes are necessary to ensure novelty and originality of the DSR artifact [2] and contribution towards design theorizing [6], [7].

Issue 9 – Parallel projects: Iivari [9] discussed the potentials for addressing the classes of problems in parallel organizational settings. This approach was approached especially in cases 2 and 3. The alignment process of DSR meta-artifacts to varying settings might cause methodological problems and disrupt a rigorous research approach. However, such array projects can also be hugely beneficial since the design science researcher harmonizes, validates and proves the applicability and the novelty of the artifacts in differing settings.

5 Conclusions and Further Work

This research in progress-article serves as a discussion starter for managing the role of the researcher in within emergent DSR activities that are embedded to temporary IS-projects. The article presented considerations towards a meta-level monitoring approach on how to deal with the emergent nature of DSR once embedded to organizational and interdisciplinary activities. The DSR community needs to widen the discussion on organizational involvement to increase the practical value and the contribution of the research attempts to businesses by direct integration of DSR artifacts to solve organizational problems through interdisciplinary research efforts.

The next steps to take include the widening of the perspectives on epistemology and theorizing by deepening the discussion on emergent DSR. The work towards a METADSR model will be extended to consider different types of artifacts and to form a linkage between the issues to be monitored with a solution space offering DSR interventions to solve the particular challenges.

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