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# Addressing the Practical Impact of Design Science Research

*Emergent Research Forum (ERF)*

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## Abstract

Design science research (DSR) has established itself as an integral and continuously evolving part of information systems research. Aspects that recently became apparent are what design knowledge is and how it should be communicated to achieve a high impact. However, the question remains, whether DSR contributions find their way into practice. In this research in progress paper, we open and conceptualize the problem space (an assumed lack of practical impact) and conduct a systematic literature review of DSR literature to survey DSR researchers about their perception of a practical impact. The results show that DSR researchers think that their created artifacts either already found their way into practice or will in the future, but more measures are necessary to increase their impact. To ground this perception and further conceptualize the problem space, more steps are necessarily leading to our overall goal: a framework to position DSR research for maximum practical impact.

## Keywords

Design science research, practical impact, practice, ivory tower, text mining.

## Introduction

Since the seminal publication of Hevner et al. (2004), design science research (DSR) has established itself as an integral part of information systems (IS) research. From there on, the research paradigm has been continuously developed and extended. A focus that has become apparent in recent years is above all the question of what design knowledge is, how it can be developed and manifested and how research results should be communicated to achieve the highest possible impact (vom Brocke et al. 2020; vom Brocke and Maedche 2019; Gregor and Hevner 2013; Hevner 2021; Rothe et al. 2020). Often a dilemma arises to generalize design knowledge, because DSR projects are inseparably linked to their context (zur Heiden 2020). However, research is frequently accused of generating knowledge only for the sake of generating knowledge. A phenomenon often referred to as “ivory tower”, from which even DSR research cannot fully exempt itself (van Aken et al. 2016; Hevner and Chatterjee 2010). DSR researchers normally address these accusations with claims that their “research resulted in a commercial product that has been used in over two dozen real use situations” (Markus et al., 2002, p. 187). The relevance for practice, which is often pointed out in the conclusion or in the contribution part of a paper (Gregor and Hevner 2013), often promises a manifold contribution for practice and that designers can and should use the generated design knowledge to achieve an intended effect with their artifacts. Although many efforts are underway to conduct better DSR research that not only optimally incorporates the problem space and pursues artifact design in a scientifically rigorous manner, the question remains to what extent generated design knowledge makes it into practice (van Aken et al. 2016; Hevner and Chatterjee 2010). Against this backdrop, we aim to address the following overarching research question in our DSR project:

**RQ:** How to increase the practical impact of DSR?

In line with Maedche et al. (2019) in specific, we start with the conceptualization of the problem space, which in our case is the exploratory investigation of DSR contributions in the form of scientific

publications. With the help of a systematic literature screening, we capture DSR publications published over the last 10 years. With the help of an exploratory questionnaire sent out to all authors of the 403 articles we identified, we capture the perception of whether their constructed artifact is applied in practice. This research in progress paper (ERF) presents the results of the systematic literature review and the exploratory survey, which lays the foundation for answering our research question.

## **Practical Impact of Design Science Research**

There is an ongoing discussion about the practice research gap, not only in management sciences but also in IS research (Wynn 2019). Straub and Ang (2011) address this gap and divide it into two different problems, namely the usefulness of researched topics for practitioners (also investigated by Bary et al. (2018)) and the transfer of scientific knowledge from the research to the practitioners domain. Further on, Wynn (2019) give three interconnected reasons for the practice research gap to exist: separation, divergent goals and incommensurability. Moshonsky et al., (2019) see one of the main problems in the availability of scientific literature to practitioners. In the context of DSR, Hevner et al. (2004) argue that “the dangers of a design-science research paradigm are an overemphasis on the technological artifacts and a failure to maintain an adequate theory base, potentially resulting in well-designed artifacts that are useless in real organizational settings” (p. 98). Furthermore, Hevner and Chatterjee (2010) argue that “if the new artifact does not map adequately to the real world (rigor), it cannot provide utility” (p. 285). The authors thus argue that only through a distinctive rigor cycle that incorporates the theory base, well-designed artifacts are created that can be used in the organizational setting. This line of reasoning stems from the fundamental motivation to perform design activities with scientific rigor in order to create artifacts that have been well-designed with the help of the scientific knowledge base (rigor cycle) (Hevner et al. 2004; Simon 1996). However, this approach does not yet guarantee an integration of the generated design knowledge into practice. Gregor and Hevner (2013) recite the statement of Hevner et al. (2004) that “effective DSR should make clear contributions to the real-world application environment from which the research problem or opportunity is drawn“ (p. 342), which has been recognized as a key distinguishing feature of DSR. This distinct approach of DSR projects with their close interlocking of the problem space and the context, therefore, seemingly testifies to a high practical relevance of the generated knowledge (zur Heiden 2020; Maedche et al. 2019). Yet, the approach presumably ensures that DSR researchers capture an apparently existing problem from practice and develop a solution for it (Hevner et al. 2004). The procedure itself does not yet ensure that the generated solution is carried into the organizational setting. Thus, it can be said that the abstract nature of DSR knowledge is one reason why it cannot be adequately transferred into practice (Gregor and Hevner 2013; Iivari et al. 2021). Consequently, communication is a crucial point to promote the impact for practice (Gregor and Hevner 2013; Peffers et al. 2007). The question remains, however, which other factors play a decisive role for the practical impact.

## **Methodology**

Our research follows the DSR paradigm with the goal to provide researchers with a framework to ensure a higher practical impact (Gregor and Hevner 2013). In the first step we conceptualize the problem space in the best way possible to consequently justify the relevance of the phenomenon (Maedche et al. 2019). In doing so, we focus on the stakeholders of the environment, which in our case are DSR researchers and designers or potential beneficiaries of design knowledge. The aim is not only to identify the stakeholders, but also to ascertain their goals and needs, which can certainly vary widely between researchers and practitioners (Norman 2010). To capture the environment, we first conduct a systematic literature review. We then conduct an exploratory survey with DSR researchers to capture their views and opinions on the perceived practical impact. In this research in progress paper (ERF), we report the results of the quantitative and qualitative analysis of the conducted survey and a synthesis of the insights.

## **Systematic Literature Review**

We follow Webster and Watson's (2002) guidelines for literature reviews in IS. We limited our literature search to the “Senior Scholars' Basket of Journals”, as well as to publications in the proceedings of the DESRIST. Furthermore, the search of the publications in the journals is limited to the period of 10 years (2012-2021), because researchers might not respond to our survey due to leaving academia or changing emails. In the first step, a search was performed using the keywords "design science" and "design research" similar to the approach by zur Heiden, (2020), which yielded 866 hits. These selected papers

were analyzed for the application of DSR in a scientific context and all papers that did not create or contribute to the creation of an artifact in the sense of Hevner et al. (2004) and Gregor and Hevner (2013) were excluded. After analyzing the pre-selected 866 papers, 53.1% of the papers were excluded. 406 papers with the specified content remained for further analysis (see table 1).

<b>Journal</b>	<b>Initial hits</b>	<b>Filtered paper</b>
<i>European Journal of Information Systems</i>	159	25
<i>Information Systems Journal</i>	38	15
<i>Information Systems Research</i>	45	15
<i>Journal of the Association for Information Systems</i>	80	32
<i>Journal of Information Technology</i>	36	9
<i>Journal of Management Information Systems</i>	68	35
<i>Journal of Strategic Information Systems</i>	18	2
<i>MIS Quarterly</i>	76	26
<i>DESRIST Proceedings</i>	346	247
<b>Total</b>	<b>866</b>	<b>406</b>

**Table 1. Identified and filtered papers of the systematic literature review**

## Survey

In the next step, all authors of the remaining papers with their corresponding email addresses were extracted resulting in 776 email addresses and an exploratory online questionnaire was constructed. The questions of our questionnaire were constructed using a mixed method approach, including both qualitative and quantitative questions. The questionnaire contained a total of 21 questions, which was divided into four basic categories (artifact, design of the artifact, practical impact, personal information). In total, the survey was sent out to 776 researchers. However, 185 addresses could not be reached because they no longer existed at that time (i.e., mailer daemon error), leaving 591 successfully sent emails.

## Results

A total of 104 participants took part in our survey of which 76 completed the survey in full (12,85% response rate). The questionnaire was analyzed both quantitatively (descriptive) and qualitatively (qualitative content analysis of the open-ended questions). Our participants are primarily professors (37.7%) or research associates (30.4%). Furthermore, 17.4% are junior professors (including assistant professors), and only 5.8% are student assistants (8.7% indicated "other" or didn't provide an answer). 90.5% of our participants work in academia, 5.3% work in both academia and practice, and 4.2% are practitioners. The majority (45.8%) have been using the DSR research paradigm for more than 8 years, followed by researchers with 4-6 years of DSR experience (19%) and with 6-8 years of experience (12%). Only a small proportion (8%) have been using DSR for less than 2 years. 15.2% didn't provide an answer to that question or answered, "I don't know".

Asking about the number of created artifacts and their origin, 63.3% of our participants stated that they have already designed more than four artifacts. 11.8% have designed two artifacts, 7.9% three artifacts, and 2.6% four artifacts. Because some questions relate to a specific artifact, we asked participants to limit their responses to their most relevant artifact. We asked the participants to indicate what kind of artifact they created according to Gregor and Hevner (2013), showing that most participants answered "prototype" (26.1%), followed by "software product" and "model" (both 15.9%) and "method" (13.6%). "Design principle" was answered by 11.4% and "design theory" by 5.7%. In addition, we asked about the origin from which the reason for the development of the artifact resulted according to (Hevner et al. (2004) and Gregor and Hevner (2013) (multiple answers were possible). Most participants mentioned that the artifact resulted through the application of technology (44.3% said yes) or organizational processes (53.4% said yes). Third was the capabilities of the people of the problem space (34% said yes). Further, we specifically asked what artifact level their artifact is according to Gregor and Hevner (2013), which most participants didn't give an answer or couldn't provide an answer (58.8%). 5.7% said that their artifact couldn't be put into any level, 4.5% indicated level 3, 4.5% indicated level 1 and 20.5% of our participants indicated level 2. However, participants are indecisive (Mean = 3.12; SD = 1.2; 1 = very unhelpful to 5 = very helpful) on whether it is helpful to position their artifact into the three levels

according to Gregor and Hevner (2013). When asked if their artifact has already been used in practice, 65.8% answered yes and 23.3% answered no. 10.9% said they were not sure or did not know. However, 71.2% of respondents indicate that they believe it is either very likely or likely that their artifact will be used in practice in the future. However, 16.4% are unsure and 11% say they think it is unlikely or very unlikely. 1.4% did not provide an answer to this question. 52.1% feel that their artifact was described well enough for practice. In contrast, 30.1% think that they could have described it better, which was elaborated further (see qualitative results).

The participants produced 4,464 words of text within the open-ended questions, which we analyzed following an inductive qualitative content analysis approach (Mayring 2014) by identifying patterns within the given answers and categorizing them accordingly. This process resulted in overall eleven identified patterns which are briefly presented in the following:

**P1: Consultation and presentation of the artifact:** Measures to be taken in order to make the generated design knowledge more accessible and tangible.

**P2: Increase resources and support:** Increase resources of the DSR researchers such as personnel, money or time and increase support for DSR researchers.

**P3: Involvement of practitioners:** Participatory methods to involve practitioners into the design cycle.

**P4: Further development and adoption:** Further develop and/or adapt the artifact for a better practical impact.

**P5: Set priorities in the design cycle:** Set priorities in favor of the practical impact in the design of the artifact (e.g., might sacrifice rigor).

**P6: Launch DSR projects in close cooperation:** The beginning/emergence of DSR projects should be in close cooperation with practice or analysis of the problem.

**P7: Platforms and databases for publication/dissemination:** Create channels for communication specifically for practice and literature specifically for practice.

**P8: Use of other methods or paradigms:** Use of methods that focus on high external validity.

**P9: Deviation from DSR:** Deviate from DSR processes and guidelines in order to increase relevance and practical impact.

**P10: Focus on certain artifacts:** Focus on artifacts that can easily be implemented in practice (less abstract, more specific).

**P11: Recognition/understanding of DSR:** Increase the overall recognition and understanding of DSR in practice.

## Synthesis and Further Steps

Our results show first insights into our problem space, the assumed lack of practical impact of DSR, from the perspective of the researcher, which needs to be further elaborated in order to understand how the research practice gap manifests itself in DSR in particular and how a solution for it can be created (Maedche et al. 2019). Our next steps include a mix of automatic text mining techniques (e.g., topic modeling) to identify clusters of recurring themes within the identified articles but also a qualitative content analysis of the identified articles (potentially redoing the systematic literature review involving other outlets such as AIS conferences) to shed light on the type of contribution (artifact), applied methods, problem space and context but also the way the knowledge was communicated to achieve a broader understanding of where the problem might occur. In addition, we want to take a closer look at the “other side” of the stakeholder group: practitioners that work as strategic designers, user researchers, digital designers, software engineers, or other design-related positions to better conceive the gap between the perceptions of DSR researchers and practitioners (Maedche et al. 2019). Since the DSR researchers we interviewed largely assume that their knowledge is applied in practice, we want to investigate this assumption and aim to get a deeper understanding on whether and how practitioners consume, apply, and possibly replicate design knowledge. After conceptualizing the problem space, we plan to design a framework that incorporates methods and procedures from other disciplines (Bary et al. 2018; Norman 2010; Pan and Pee 2020; Rai 2019; Rynes et al. 2001; Straub and Ang 2011) and is developed specifically for DSR projects. Further, we aim to evaluate the framework by interviewing participants of our prior sample (DSR researchers and practitioners) and by applying the framework to a future DSR project.

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