Guidelines for Conducting Design Science Research in Information Systems

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Abstract. Information Systems (IS) as a discipline is still young and is continuously involved in building its own research knowledge base. Design Science Research (DSR) in IS is a research strategy for design that has emerged in the last 16 years. IS researchers are often lost when they start with a project in DSR, especially young researchers. We identified a need for a set of guidelines with supporting reference literature that can assist such novice users of DSR. We identified major themes relevant to DSR and proposed a set of six guidelines for the novice researcher supported with references summaries of seminal works from the IS DSR literature. We believe that someone new to the field can use these guidelines to prepare him/herself to embark on a DSR study.

Keywords: Design Science Research, Design Science Guidelines, Design Science Process, Design, Artefact, Information Systems, Methodology for Design Science.

1 Introduction

Design Science Research (DSR) in Information Systems (IS) has received significant attention in the last 16 years and is now accepted as an approach in top IS publication outlets such as MISQ [1]. In DSR we differentiate between *design* and a *design theory,* where design focuses on the "use of scientific principles, technical information and imagination in the definition of a structure, machine or system to perform pre-specified functions with the maximum economy and efficiency" and design theory is "a prescriptive theory based on theoretical underpinnings which says how a design process can be carried out in a way which is both effective and feasible" [2:36-37]. One of the first

references in IS to the concept of *design science (DS)* was in 1993 when Cross [3:66] referred to DS as "an explicitly organized, rational and wholly systematic approach to design". Bayazit [4] focused on the concept of man-made things when he "defined *design research* as a systematic inquiry whose goal is knowledge of, or in, the embodiment of configuration, composition, structure, purpose, value, and meaning in man-made things and systems" [4:16]. In contrast, Hevner [5:76] focuses more on the practical nature of DSR when he refers to *design science* as "fundamentally a problem solving paradigm. DS seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of IS can be effectively and efficiently accomplished".

Because of the many DS and DSR discourses, novice researchers in postgraduate studies introduced to the world of research in IS experience challenges in making sense of the concepts. Adopting DSR as the appropriate approach to use in research requires from the researcher in-depth understanding of the literature and the progression of the field. It is however, imperative to understand that there have been different viewpoints in the field, for example, on what could be considered as a research contribution, how DSR should be executed and what the underpinning philosophy of DSR is. It is important for the novice DSR researcher to take cognisance of these viewpoints, but it should also be understood that guidance is needed to assist the researcher in embarking on DSR. The purpose of this paper is therefore to contribute to the understanding of the novice researcher in DSR of the concepts on which to focus and to give an overview of the leading works that should be considered in preparing to embark on a DSR research project.

In this paper, we will first discuss how we conducted the research in section 2, followed by the suggested guidelines in section 3, before proceeding to an overview of the different concepts to be consulted by the novice researcher or postgraduate student. We conclude the paper in section 4 with some suggestions for further discourse.

2 Research Method

The focus of this paper is on giving guidelines and discussing some of the concepts that we believe are of importance to the novice researcher or postgraduate student. We followed a two-phase approach in our research to answer the research questions listed in Table 1.

Table 1. Research questions.

Research questions	Data Collection
RQ1: What are the guidelines supervisors give to novice DS researchers embarking on a new DSR project?	Focus group
RQ2: Who are the key DSR research leaders to consult for the different concepts identified in RQ1?	Review of the literature
RQ3: What are the seminal works that should be considered by a novice DS researcher?	

The two-phase approach (describe in Section 3.1 and 3.2) consists of involving a focus group to answer the first research question and a systematic review of the literature in the second phase to answer the second and third research questions.

For the first phase, the focus group, we used the guidelines provided by Barber and Rossi [6], with three experienced DSR supervisors selected using convenience sampling, from the University of Pretoria. The supervisors have been collectively involved in supervision of 26 PhD and Masters students who used the DSR approach in their research. The focus group was conducted as a group interview with the goal to capture the way in which the supervisors guide the researcher new to DSR in finding his/her way in order to execute a DSR study. The summarised notes were analysed with two goals – firstly to identify the themes (Table 2) and secondly to identify the guidelines (Table 2) linked to the themes on conducting DSR research. After the themes were identified by the focus group, a short survey was send out to 22 experienced supervisors at different universities to confirm the themes. There was a response from 13 supervisors from nine different universities where the themes were confirmed with all of them indicating that the DSR process is the most important theme.

The second phase of the project was to identify the research leaders in DSR, linked to the themes identified in the first phase, and to ensure that we were able to give guidance in this paper on the seminal works linked to the themes. We followed the steps of a systematic literature review with the goal to describe available knowledge. This is in line with Okoli [7:82], who states that "one of the reasons for conducting a systematic literature review is to describe available knowledge for professional practice". An eight-step process was followed in the review [7], including 1) identifying the purpose, 2) drafting protocol, 3) applying practical screen, 4) searching for literature, 5) extracting data, 6) appraising quality, 7) synthesising studies and 8) writing the review.

For the first step, *identifying the purpose*, the research questions were used as guideline. The *draft protocol* was compiled together with the *application of the practical screen*, where the procedure was discussed that would be used during the systematic literature review. The search terms identified included the following terms (and combinations of the terms), "design science", "design science research", "design research" and "information systems". During the fourth step, s*earching for literature*, we started with the *basket of eight in IS* [8], followed by searches for publications in DESRIST [9]. (DESRIST has hosted a conference every year since 2006 focusing on DSR in IS.) We used an iterative process during the search process: if a publication in later years referenced earlier works that were not in the initial set, these were also included. This extended the documents to include material from other sources not listed above. We excluded works from other fields, such as Education, Engineering and Economic and Management Sciences, since our focus was specifically only on IS. We acknowledge that there might be valuable resources available in these fields, but we believe that this opens up a new research topic where future research is possible to see how the different fields align, especially from a practice point of view. We did not include papers focusing only on DSR examples or case studies - all papers contributed to the themes identified in the first phase (focus group) of the data collection. In total 124 papers were identified, which were captured in an Excel spreadsheet and included in the remaining analysis. Our next step was to *extract the data*, where the extraction consisted of doing

a Google scholar classification for each paper to indicate the citation as in February 2019 (this information was used to identify the most referenced papers) and then the papers were sorted according to citation value. The next step was to *appraise the quality*, where each paper was classified according to the themes identified in the focus group sessions and papers that did not align to one of the themes were excluded. We *synthesised the studies* by firstly grouping together studies that focused on specific themes with high citations and then as a second step considering papers with lower citations that focused on topics relevant to the themes identified for DSR. The last step was to communicate the results of the research, as was done in this paper.

3 An Information Systems Design Science Research Roadmap

3.1 Phase 1: DSR Guidelines and Themes

The first phase of the data analysis was based on the data collected during the focus group session. Firstly, seven themes were identified as pertinent in DSR for the novice researcher. These themes were categorised into three broader focus areas, including the *positioning of DSR, the research design* and *communication* (Table 2).

Table 2. Themes for conducting DSR.

Focus Area	Theme	Description
Positioning of DSR	Artefact	"Design science products are of four types: constructs, models, methods, and implementations" [10].
	Relevance/Rigour/Practice	This theme focuses on the discussion of DSR as a practice (relevance) but also contributes to existing theory (rigour) [5].
	Design theory	Design theories are also seen as a product of DSR by several authors [11] and emerged as theme.
Research Design	Philosophy	In conducting research, the ontological stance of the researcher is discussed during the research design.
	Method	The method followed during DSR was one of the first focus areas in the development of DSR as a field [12]
Communication	Argument	This relates to how the researcher communicates the research to the research community.
	Thesis	This relates to guidelines in sharing the processes of the DSR and the new knowledge related to the creation of the artefact or the nature of the artefact.

For the focus area, *positioning of DSR*, the focus is on the artefact, the relevance/rigour of creating the artefact and the design theory. A second focus area relates to the *design of the research* and focuses on the philosophy and the method (or process) followed. The last focus area relates to the *communication* of the design process followed, where the researcher should focus on the argument and guidelines relating to structuring the thesis/publication. After identification of the focus areas and themes, guidelines were identified that would help the novice researcher or postgraduate student to conduct DSR (Table 3).

Table 3. Guidelines for the novice researcher/postgraduate student.

Guidelines
1. Contextualise DSR in the field of Information Systems and be able to distinguish between concepts such as design, design science and DSR.
2. Understand the philosophical underpinning of research and the discourse on the nature of DSR.
3. Obtain a historical perspective of DSR and consult the work of the pioneers in the field.
4. Consider the role of the artefact in DSR and the different views on design theory.
5. Select an appropriate DSR method for execution of the research study.
6. Strategise on how research done in DSR should be communicated in a report such as a thesis.

3.2 Phase 2: The relevant DSR content according to the guidelines and themes

In this section, we discuss the literature that was identified during the systematic literature review according to the themes and the guidelines identified.

Guideline 1: *Contextualise DSR in the field of Information Systems and be able to distinguish between concepts such as design, design science and DSR.*

In IS novice researchers are exposed to different research directions either by supervisors or more formally in courses taken by students as part of their preparation for a research project. In a research project the researcher will typically start exploring the problem, read the literature and explore different directions to conduct the research, depending on what the researcher has been exposed to or guidance given by a mentor. During this phase the researcher might consider DSR if he/she is involved in the process of design.

DSR is often discussed from the perspective of the science of the artificial, as done by Simon [13], who introduced the notion that one can study the artefact as part of science in 1969. We do acknowledge that the concept of design was used in other fields, such as engineering, but in IS the work of Simon as originally written in 1969 and revised in a second and a third edition [13] is cited by many authors as a seminal work. Gregory [14] argues that in doing design one is creating something that does not exist. There are two concepts of importance in this argument – there is creation of something (the artefact) and there is the process of creation. Design is therefore "both a noun and a verb" [14:3] or a process and a product. In 1992 Walls [2] emphasised that we as IS practitioners and IS users have been involved in the process of design for several years through systems development.

As mentioned in the introduction, Cross [3] in 1993 described "*DS* as a systematic approach to design". In the same year Smith and Browne [15] also focused on the topic of DS and emphasised the difficulties in design due to human involvement. Smith and

Browne [15] argue that Simon's [16] view was a DS view, although Simon never used the term DS – Simon referred to the science of design. According to Smith and Browne [15], DS should focus on understanding the designer as well as on the processes to be used for design. Another view is that of March and Smith [10], who contrast natural science and DS and argue that DS "is concerned with the creation of artefacts to attain goals that serve human purposes" [10:253].

DSR in IS reached a milestone in 2004 with Hevner et al. [5] presenting their framework for IS research and guidelines for DSR. In this work they referred to DSR as a paradigm where the "knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artefact" [5:75]. More or less in the same timeframe Vaishnavi, Keuchler and Petter [17] started a web site focusing on DSR in IS. According to them, "DSR uses a set of synthetic and analytical techniques and perspectives for performing research in IS". Furthermore, they define "DSR as being involved in the creation of new knowledge, firstly through the development of artefacts and secondly through the study of the use of the artefact afterwards".

Guideline 2: Understand the philosophical underpinning of research and the discourse on the nature of DSR.

In conducting the data collection on the philosophy theme, only works were included that explicitly discuss the philosophical stand of DSR. Research conducted in IS is mostly multi-disciplinary and the philosophy mostly used is either positivist, interpretivist or critical research. In the papers reviewed, three discourses emerged, including 1) DSR as paradigm 2) Traditional paradigms and 3) Pragmatism paradigm.

DSR as paradigm: Originally Vaishnavi, Keuchler and Petter [17] discussed DSR as a paradigm on its own. They argued that design can be research and that it changes the world through the development of new artefacts. Their initial ideas were shared on a website hosted by DESRIST and later replicated in a book [18] in which they contrast interpretivism, positivism and DSR in tabular format. We summarize their full table as a partial view of their comparison to show how DSR is described (Table 4).

Table 4. Philosophical assumption of DSR [18].

Ontology	Epistemology	Methodology	Axiology
Multiple, contextually situated alternative world-states. Socio-technologically enabled	Knowing through making: objectively constrained construction within a context. Iterative circumscription reveals meaning	Developmental. Measure artefactual impacts on the composite system	Control; creation; problem-solving; progress (i.e., improvement); understanding

Cross [19] also argues for the recognition of DSR as discipline – he states that we can have discussions on design and the value of the creative activity and share experiences of the process. He further argues that designers understand and know the artificial world and know how to change and add to this world.

Traditional paradigms: In the second discourse on philosophical grounding of DSR, arguments are provided for the use of philosophies traditionally used in IS, such as interpretivism or positivism. Gregory [14] claims that "DSR is conducted most frequently within a positivistic epistemological perspective". Venable [20] proposes a framework for understanding design research where the framework focuses on theory building as well as evaluation of the solutions from a positivist or interpretivist angle. Carlsson [21] proposes a framework of IS DSR with the aim to develop practical knowledge for the design and realisation of IS initiatives" (including socio-technical systems). His underpinning philosophy of the framework is critical realism - critical realism's manifesto is to "recognize the reality of the natural order and the events and discourses of the social world. It holds that we will only be able to understand — and so change — the social world if we identify the structures at work that generate those events or discourses" [21:200].

Pragmatism as paradigm: March and Smith [10] were some of the first authors to emphasise pragmatism when they argued that truth is what works in practice. Hevner in 2007 [22] devoted the closure of his article to claiming pragmatism as the nature of DSR. His view of pragmatism is a "school of thought that considers practical consequences or real effects to be vital components of both meaning and truth" [22:93]. He argues that the synergy between practical and theoretical contributions is what defines good DSR. His view is confirmed in other, later papers [23]–[25]. A meaningful source on the nature of DSR is the paper by Goldkuhl [25]. In this seminal work, he investigates the epistemological foundation for design research and argues that the pragmatist perspective is fit for DSR based on the focus on utility and knowledge growth through development, starting with a problematic situation and aiming for knowledge building. Deng, [26] in a recent work, argues that pragmatism is the underpinning philosophy for DSR, but goes through different phases where the researcher is involved as interpretivist, positivist and constructive observer or intervener (Fig. 1).

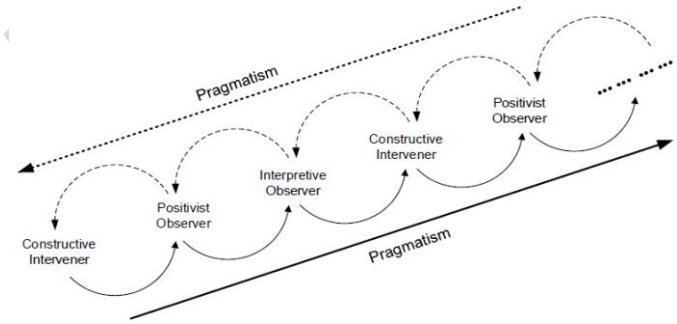

Fig. 1. Iterative design science process [26].

Guideline 3: Obtain a historical perspective of DSR and consult the work of the pioneers in the field.

As mentioned previously, the field of DSR evolved much earlier in other fields such as engineering and architecture. The most frequently cited work in IS is the work of Simon [13], [16] where he argues for the acceptance of the study and development of artificial or man-made objects. He also refers to problems experienced in management and indicates how well-designed systems contributed as artificial objects to solutions in the field of IS.

Following the work of Simon [13], [16] in terms of the highest number of citations was the seminal work of Hevner et al. [5] in 2004, in which they contrasted behavioural science and DS. In their article, with more than 11 400 citations to date, they presented a framework (Fig. 2) for IS research and also provided a set of guidelines for DSR.

Hevner et al. [5] argue that IS research has the dual value of rigour and relevance. From the rigour side, as can be seen in Fig. 2, the researcher gets applicable knowledge from the knowledge base, including existing theories, frameworks etc. On the relevance side the need for a new artefact arises, articulated as business needs in Fig. 2. Business needs from the environment can stem from people, technology or organisations. In the centre are the activities related to development, building and evaluation of the new artefact. At the bottom of Fig. 2, the contribution is both back to the environment in the form of an artefact with practical value and to rigour in the form of new knowledge. A further contribution in the paper is the guidelines provided by Hevner et al. [5], summarised in Table 3.

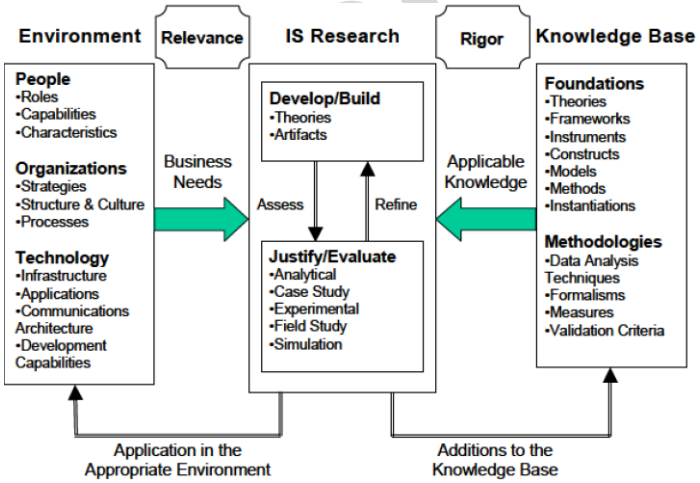

Fig. 2. IS research framework [5].

Prior to the work of Hevner et al. [5], three papers were published in the 1990s that led to significant citations. These included that of March and Smith [10], which proposed the four types of artefacts referenced in later years by several authors, that of Walls et al. [2], which focused on the creation of a design theory (Guideline 4) and that of Nunamaker et al. [27], which proposed to conduct design research based on the system analysis and design method (Guideline 5). In 2007 Gregor and Jones [28] built

on the work of Walls et al. [2] in design theory (Guideline 4) and distinguished between a product and a process artefact. Gregor and Hevner [29] elaborated on the nature of design research and provided a guide for reporting on and communicating DSR (Guideline 6). These papers are seen as seminal works and are summarised in Table 4.

Table 3. DSR guidelines [5].

Guidelines	
"Guideline 1: Design as an Artefact	Design science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
Guideline 5: Research Rigour	Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.
Guideline 6: Design as a Search Process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design science research must be presented effectively to both technology-oriented and management-oriented audiences."

Table 4. Seminal works in DSR [18].

Reference	Citations	Year	Significance
March et al. [10]	3 979	1995	Initially proposed types of artefacts
Walls [2]	1 530	1992	Focuses on design theory - Provides a method for theory building;
Nunamaker et al. [27]	1 508	1991	Proposes a method – argues from the system development background for design
Gregor and Jones [28]	1 428	2007	Focuses on design theory; distinguishes between two different kinds of purposeful artefacts that can be designed: product artefacts and process artefacts.
Gregor and Hevner [29]	1 402	2013	Overview article; positions DSR; gives guidance on publishing DSR;
Cross [19]	1 306	2001	Nature of DSR, distinguishes between scientific design, design science, a science of design
Markus et al. [30]	1 282	2002	Example of a design theory for knowledge management processes

More recent work with fewer citations that serves as a good starting point in understanding the concepts in DSR has been published by Baskerville et al. [11] and Deng and Ji [26].

In the early days of DSR, many authors argued that DSR and action research (AR) are the same. The novice researcher needs to take cognisance of these discussions and

be able to understand that though there are similarities, they are not the same. Here we recommend the work of IIvari et al. [31], [32] and Sein et al. [33]. Another contribution on the topic of AR and DSR is the work by Lee [34] that combines action and design research methods into a single framework for design.

Guideline 4: Consider the role of the artefact in DSR and the different views on design theory.

Central to DSR is the artefact – an artificial and man-made object. The first mention of different types of artefacts is by March and Smith [10] as constructs, models, methods and implementations [10]. Winter [35] gives examples of constructs that include modelling primitives implemented by meta-models of modelling tools, process models implemented as workflows as models and project methods used during software package introduction as a method.

Purao [36] claimed in 2002 that the artefact created in DSR is software or a system. Hevner and Chatterjee [24] and Vaishnavi et al. [17] also give as examples of the artefact algorithms, human/computer interfaces, languages, and system design methodologies. In 2010 Offerman et al. [37] did a literature review on the types of artefacts in IS design science and suggested a topology with eight types of artefacts. These included a system design, method, language/notation, algorithm, guideline, requirements, pattern and metric.

In 2003, Rossi and Sein [38] (in acknowledged collaboration with Purao) added "better theories" as an artefact – however, not all authors agreed. Winter [35], in an editorial, argued that "although theory building is not design science research, theories as "intermediate" artefacts need to be included in the system of relevant artefacts for IS design science research" [35:472]. Baskerville [11] emphasised that DSR brings about both practical relevance by developing useful artefacts and scientific rigour by the formulation of design theories.

The topic of design theories was discussed in the early introduction of DSR into IS. Many of the later publications build on the original work done by Walls et al. [2], who distinguished between a design product and a design process in their classification of the components of an information systems design theory (ISDT). Walls et al. [2:40] characterise "design theories as 1) dealing with goals as contingencies, 2) never involving pure explanation or prediction, 3) being prescriptive, 4) being composite theories that encompass kernel theories from natural science, social science and mathematics". They claim that whereas "explanatory theories tell *what is*, predictive theories tell *what will be* and normative theories tell *what shall be*, design theories tell *how to/because*".

It should be noted that Walls et al. [2] view theory as the design of an artefact, the method followed. This is evident when they propose ISDT as an output of design science.

Gregor [39] contributed to the discussion on theory by defining five classes of theory, design theory is the last of this set of classes, which includes "1) theory for analysing, 2) theory for explaining, 3) theory for predicting, 4) theory for explaining and predicting, and 5) theory for design and action". Gregor and Jones [28:313], in their sem-

inal work on design theory published in 2007, emphasised that "we need to pay attention to how design knowledge is expressed as theory". They extended the work of Walls et al. [2] and identified eight separate components of design theories.

Theory development will remain topical in DSR and several publications are recommended, such as the work by Kuechler and Vaishnavi [40] and Pries-Heje and Baskerville [41]. The work done by Baskerville et al. [11] should be considered as they reflect on the balance between contributions in science (theory) and technology (artefacts). They conclude in the paper that in DSR some degree of design theorising should be expected, where the initial conceptualisation of the artefact is the first step in theorising – however, "design theory (prescriptive, scientific knowledge) is a desirable goal as theorizing around a class of artefacts progresses" [11:369].

Guideline 5: Select an appropriate DSR method for execution of the research study.

Originally March and Smith [10] argued that design science consists of two basic activities, namely building and evaluating. In this section, we therefore give an overview of the subsequent pertinent works with regard to the methodology for DSR construction and then discuss the evaluation of DSR.

All the methods shared in the literature on conducting DSR consist of a combination of the general design and development phases, namely identification, design, development and testing. Vaishnavi et al. [17] published one of the often used and referenced methods that they call a DSR process model, which was based on work from Takeda et al. [12] and is illustrated in Fig. 3. In this model, they illustrate that a DSR project goes through cycles of awareness, suggestion, development, evaluation and conclusion. The knowledge or theory contribution is through circumscription illustrated on the left-hand side as an exit point to development, evaluation or conclusion. They also argue that the outputs for each phase range from the proposal during awareness, the tentative design during the suggestion phase, the artefact during development, performance measures for the evaluation and then lastly the results in the conclusion.

Another popular DSR process model used by authors is the work published by Peffers et al. [42]. In their process model (Fig. 4), the DSR cycles through "problem identification and motivation, objectives of solution, design and development, demonstration, evaluation and communication". They make provision for different entry points into the process model, depending on the type of development to be conducted. It might be that one has an existing artefact that needs refinement, which will not necessarily need to go through all the phases, but might for example enter only at the design and development phase.

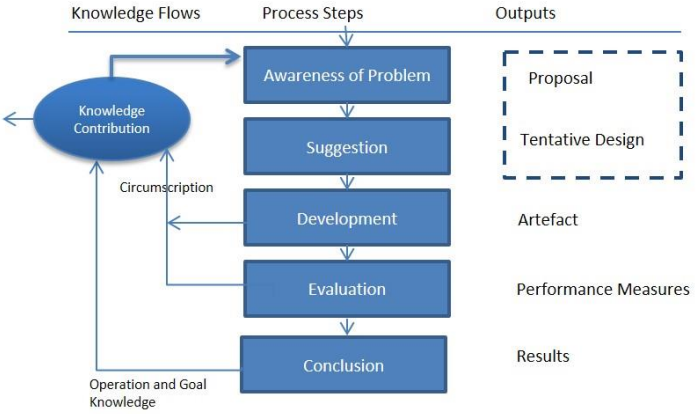

Fig. 3. DSR process model [17].

Other significant work on methods for DSR include the work done by Baskerville et al. [43], where they propose a seven-phase soft DS methodology; that of Vom Brocke and Buddendic [44], who that suggest that the DSR cycle consists of six phases; and that of Alturki et al. [45]. Vahidov [46] also presented an innovative way of developing the artefact, based on the Zachman Framework [47].

For the evaluation of the artefact, the pioneers working in this field were Pries-Heje, Baskerville and Venable, who published a number of articles [20], [48], [49] building up to a framework for evaluation in design science (FEDS) [50]. The FEDS was designed to assist DSR researchers in deciding on a way to evaluate the outcomes during development. They highlight two dimensions in their framework, namely the "functional purpose of the evaluation (formative or summative) and the paradigm of the evaluation (artificial or naturalistic)". In their framework they identified four different possible strategies, namely the "quick and simple strategy, the human risk and effectiveness evaluation strategy, the technical risk and efficacy evaluation strategy, and the purely technical artefact strategy". They then continued to provide a "four-step process for choosing an approach for a particular DSR, namely 1) explicate the goals of the evaluation, 2) choose the evaluation strategy or strategies, 3) determine the properties to be evaluated, and 4) design the individual evaluation episode(s)".
Other work on evaluation that is also significant includes the work by Cleven et al. [51], Peffers et al. [52] and Sonnenberg and Vom Brocke [53]. Valuable work was also done by Alturki et al. [45], who proposed a DS roadmap to conduct DS research. The roadmap adopts the three DS research cycles from Hevner [22], namely rigour, relevance and design. The result is a 14-step roadmap that the novice researcher can use to do DSR.

The last guideline with regard to DSR is applicable when one needs to strategise on how to communicate the results from the research. Gregor and Hevner [29] give an overview on publishing an article on DSR in which they propose a publication schema for recording results. They argue that the four questions that reviewers will ask are whether the problems

discussed in the paper are of substantial interest, whether the problems are solved or a contribution is made to a solution, whether the methods are new and whether the paper supports understanding of the area of research.

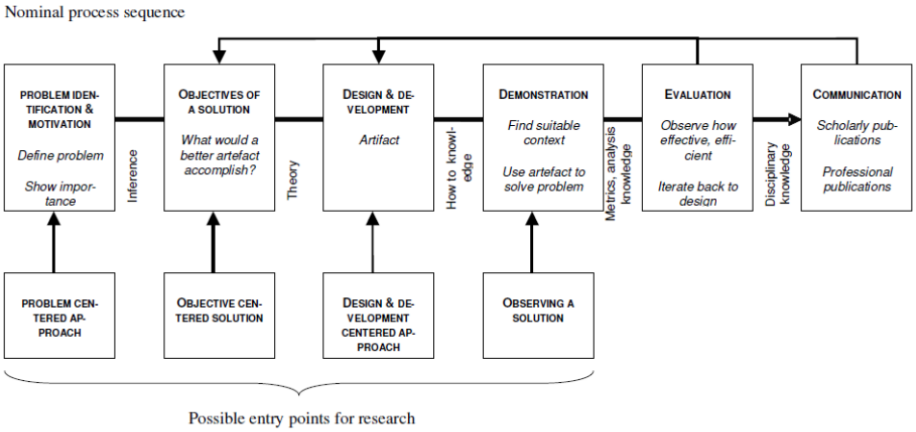

Fig. 4. DSR Process Model of Peffers et al. [42].

Guideline 6: Strategise on how research done in DSR should be communicated in a report such as a thesis.

Kotze et al. [54] used the guidelines given by Hevner et al. [5] for DSR and commented on questions to be asked for each of the guidelines. Some of the considerations are to be clear from the start on the type of artefact that will be designed, to reconsider the uniqueness of the artefact, to think about how one will do the evaluation, what the contribution will be, how one will collect data to "build" the artefact or evaluate the artefact and what the value of the artefact is.

Van der Merwe et al. [55] describe a method that a student can use to write a thesis according to the steps proposed by Vaishnavi et al. [17]. They argue that the introduction and literature review of a thesis maps to the awareness phase, the literature review and research design map to the suggestion phase, the research design and body of the thesis give an overview of the development, while the body of the thesis should also report on the evaluation phase. The last phase, the conclusion, will then also be handled in the conclusion of the thesis.

Conclusion

In this paper, we provide an overview of DSR to act as a guide for a novice IS researcher embarking on a DSR study. After identifying the major themes relevant to a DSR study and proposing a set of six guidelines for the novice researcher, we support the guidelines with a knowledge overview referring to the seminal works from the literature. The

value contribution of this study is two-fold. Firstly, a researcher unfamiliar with the field can follow the guidelines to prepare him/herself to conduct the DSR study. Secondly, the seminal DSR works to date within IS are included, which acts as a reference guide to the researcher.

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