Comparing Key Characteristics Of Design Science Research As An Approach And Paradigm

Sven Weber
E-Finance Lab, Goethe University Frankfurt, Frankfurt, Germany, svweber@wiwi.uni-frankfurt.de

Follow this and additional works at: http://aisel.aisnet.org/pacis2012

Recommended Citation
http://aisel.aisnet.org/pacis2012/180

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2012 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.
COMPARING KEY CHARACTERISTICS OF DESIGN SCIENCE RESEARCH AS AN APPROACH AND PARADIGM

Sven Weber, E-Finance Lab, Goethe University Frankfurt, Frankfurt, Germany, svweber@wiwi.uni-frankfurt.de

Abstract

The development of scientifically grounded IT artefacts significantly increased in the last decades. As a consequence, design science research emerged in the scientific field as a new research direction to explore the development of such IT artefacts. Thereby, design science research ensures to solve a real-world problem and to develop a theoretical contribution. The current literature differs by sorting design science research into specific research paradigms. As a consequence, some literature equalizes design science research with a new and innovative paradigm (developmentalist paradigm). However, in this paper we conduct a systematic comparison of the most salient characteristics of design science research and especially how they differ related to design science research as an approach or as a paradigm. Thereby, we stimulate a scholarly debate what the differences as well as possible similarities between both perceptions are.

Keywords: Design Science Research, Research Paradigm, Research Approach.
1 INTRODUCTION

Different philosophical assumptions have influenced information systems (IS) research in the past, such as the positivistic (Goles & Hirschheim 2000), interpretative (Glaser & Strauss 1967), and developmentalist (Goldkuhl 2004) ones. In recent years, design science research (DSR), has attracted more IS research attention, because it deals with the generation of information technology (IT) artefacts and their evaluation (Benbasat & Zmund 2003, Hevner et al. 2004). Develop and evaluate artefacts is an engineering discipline and not a completely new phenomenon (Simon 1996). However, DSR provides IS researchers the opportunity to enhance this engineering process with scientific rigor (Hevner, et al. 2004) and focuses on (IT) artefacts whereby the entire process of build and evaluate is not limited to IT (Simon 1969). The challenge that IS researchers often face in this context is to generate scientifically sound new knowledge while producing relevant research results that can be used by the industry at the same time. In this context, DSR cannot be clearly sorted into a specific research paradigm. However, Gregg et al. (2001) as well as Van Aken (2004) offer DSR as an alternative research paradigm in IS, to complement established notions. In contrast, Niehaves (2007) challenges this usage and defines DSR as a research approach, not a paradigm. In general, DSR aims to provide guidelines to researchers that enable them to create, improve, and evaluate IT artefacts (Hevner, et al. 2004, Holmström et al. 2009, March & Smith 1995, Peffers et al. 2008). However, none of the mentioned papers explored in detail the characteristics of DSR to classify whether DSR is a research approach or paradigm.

In the light of this discussion, DSR has been combined in the past with action research (e.g., Allen et al. 2000) and with ethnography (e.g., Baskerville & Stage 2001) in order to enhance the value and theoretical contribution. A more advanced approach is presented by Sein et al. (2011), who integrate DSR with action research in one model. Their model argues that design science needs to go beyond the traditional focus on the IT artefact and recognize its organizational embeddedness. By integrating design science with action research lenses, the authors are able to emphasize the organizational interventions through IT artefact deployment as well as the learning from this interventions in terms of contributions to the knowledge base.

In summary, while some IS scholars made attempts to distinguish DSR as an approach and DSR as a paradigm as well as combining DSR with other approaches, there is a lack of understanding and consensus concerning the specific characteristics of both points of view related to DSR. In this paper, we strive to help to clarify and classify DSR as an approach or paradigm to support scholars that are using DSR in their research. Consequently, the central research questions we are aiming at in this paper are:

Which characteristics are representative for DSR?

How do they differ related to a DSR approach and paradigm?

The remainder of this paper is structured as follows: The next section presents basic differences between the definition of a paradigm and an approach. Afterwards, a short description of the research design is given and thereafter the derived key characteristics are explained. The following two sections present the key characteristics of DSR as an approach and DSR as a paradigm in detail. Finally, the paper summarizes the insights and concludes with a discussion of the implications for DSR.

2 PARADIGM VS. APPROACH

This section defines shortly our perception of a research paradigm and approach. A research paradigm is a representation of a worldview that defines the world and environment as well as the individual’s place in this world. In this context, the relationships between different parts and the shared rules of the world are defined by the paradigm (Guba & Lincoln 1994, Kuhn 1977, Kuhn 1962). However, according to Kuhn (1977), this representation of a worldview is not steady but rather diversifies over
time. Paradigms have no sharp borders and can overlap depending on what methods and approaches are related to the paradigm (Burrell & Morgan 1979, Kuhn 1977, Lincoln & Guba 2000). Another related definition is given by Filestead (1979): a paradigm is a ‘set of interrelated assumptions about the social world which provide a philosophical and conceptual framework for the organized study of that world’. Hence, Filestead (1979) defines a research paradigm rather as a framework that provides general conditions to conduct research. In this paper, we focus on Filestead's definition and define a research paradigm as a framework to conduct research. In this context, DSR appears as a research paradigm where the problem should be defined or where the problem is open. However, identified problems do not necessarily lead to effective IT artefacts because the process of design is necessarily one of partial and incremental solutions (Peffers, et al. 2008). Consequently, the problem definition only provides a broader view of the possible solution space but the objectives of a solution remain open. Weedman (2008) was confronted with such a situation and analysed the problem space and environment of a development project. Hence, the challenging question of DSR as a research paradigm is what exactly the problem in a given world is?

In contrast, a research approach involves the collection of a set of pre-defined processes or steps that have to be carried out to conduct research. The researcher is, in fact, choosing which aspects of a phenomenon to focus on (Orlikowski & Baroudi 1991). DSR as a research approach is applicable where the problem can be clearly defined and the objectives of a solution are addressed in a systematic manner, e.g. a possible solution should be better than an existing one (Peffers, et al. 2008). One example is the implementation of a new language for modelling inter-organisational business processes across heterogeneous and distributed environments (Aalst & Kumar 2003). Aalst and Kumar (2003) had to choose which aspect to focus on and how to create a solution in this well-defined problem space. Hence, a research approach is defined by the application of methods that fit into a pre-defined broader worldview (Orlikowski & Baroudi 1991).

In sum, we define a research paradigm as a broader framework that defines the social and philosophical world behind a phenomenon, and a research approach as concrete procedure to conduct research and analyze the phenomenon.

3 RESEARCH DESIGN

To explore which characteristics are representative for DSR, we searched the extant DSR literature to derive these characteristics. To structure our literature review, we used the two recommended steps of Webster and Watson (2002): identifying the relevant literature and structuring the review. Hence, we started with the most prominent paper on DSR, Hevner et al. (2004) and their framework for information systems research to identify the most salient DSR characteristics. We structured the arguments of the paper in different characteristics to meet a concept-centric approach (Webster & Watson 2002). Therefore, we derived different arguments and generalized them to the presented six characteristics. Afterwards, we searched Hevner et al.'s (2004) references for papers that are presenting analogue, supporting, and/or opposed arguments for DSR characteristics as well as separate DSR as a paradigm or approach (Mathiassen et al. 2007, p. 572). We included also a backward search (Webster & Watson 2002), to review which papers were cited by Hevner et al. (2004). The search results were checked for relevance by reading the abstract and introduction to exclude not relevant papers.

4 KEY CHARACTERISTICS OF DESIGN SCIENCE RESEARCH

4.1 Identified DSR Characteristics

Overall, we identified six DSR characteristics that are represented by Hevner et al.’s (2004) framework for information systems research. The first characteristic is represented by the environment as well as the problem space (left side of the framework in Figure 1) where DSR is conducted. For this reason a
differentiation between DSR as an approach and as a paradigm can be explained by characteristic 1
(the roots of DSR). Characteristic 2 (kernel theories) depicts the existing knowledge base and the raw
material (right side of the framework in Figure 1) from and through DSR is accomplished. The entire
process of build and evaluate an IT artefact (the central column of the framework in Figure 1) is
represented by characteristic 3 (DSR process/product). Characteristic 4 (evaluation) enables a closer
look to DSR as a process and how this process is conducted. Whereat, characteristic 5
(developmentalist characters) enables a closer look to products of DSR (e.g., IT artefacts) and how
they work as well as through which methods they were created. Characteristic 6 (theory building)
covers the entire framework of Hevner et al. (Hevner, et al. 2004) and their intention to enrich DSR
outcomes through the combination of behavioural and design science.

![Figure 1: Information systems research framework based on Hevner et al. (2004).]

4.2 Literature Review

Table 1 provides a detailed overview of the prior mentioned DSR characteristics and how they are
separated into DSR as an approach and DSR as a paradigm. Overall, six categories were analyzed and
detailed from the reviewing process of the extant DSR literature starting by Hevner et al. (2004). By
comparing the different characteristics of DSR as an approach and DSR as a paradigm, we explore
some specific differences between these two points of view.

<table>
<thead>
<tr>
<th>No.</th>
<th>Identified characteristic</th>
<th>DSR as an approach</th>
<th>DSR as a paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Roots of DSR (Simon 1996)</td>
<td>Approach-1: DSR has its roots in the engineering discipline and aims to define a problem solution.</td>
<td>Paradigm-1: DSR is both, a process of developing new solutions to existing problems and matching existing solutions to new problems.</td>
</tr>
<tr>
<td>2</td>
<td>Kernel theories (Walls et al. 1992)</td>
<td>Approach-2: The underlying kernel theories of a DSR approach are influenced and influencing the requirements of the IT artefact and therewith the problem solution.</td>
<td>Paradigm-2: DSR reflects to IS design theory components and thereby forms a conceptual framework for the organized study of the world.</td>
</tr>
</tbody>
</table>
### Table 1. Comparison of characteristics of DSR as an approach and as a paradigm.

<table>
<thead>
<tr>
<th></th>
<th>Approach-1: The relevant end products of a DSR approach are IT artefacts. They are either constructs, methods, models, instantiations, or a combination thereof. Thereby, they provide real-world outcomes and not an overall description of the world.</th>
<th>Paradigm-1: The design process of DSR is distinguished into the building and evaluation of the IT artefact. Thereby, a feedback loop ensures the refinement of the design process. Moreover, the IT artefact is not naturally occurring and always embedded in some place, time, and community.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>DSR process/product (Walls, et al. 1992)</td>
<td>Paradigm-2: The design process of the IT artefact inhibits a circular process of refinement and improvement of the IT artefact. The IT artefact is not naturally occurring and has to be developed and evaluated. Paradigm-3: DSR depicts a further paradigm that exists in harmony with the other ones. In this developmentalist paradigm, a high responsibility lies on the construction and evaluation of technology.</td>
</tr>
<tr>
<td>4</td>
<td>Evaluation (Hevner, et al. 2004)</td>
<td>Paradigm-4: The evaluation part can be conducted in a technical, interpretative, or in a positivistic manner and thereby combines the advantages of different paradigms.</td>
</tr>
<tr>
<td>5</td>
<td>Developmentalist characters (Gregg, et al. 2001)</td>
<td>Paradigm-5: DSR depicts a further paradigm that exists in harmony with the other ones. In this developmentalist paradigm, a high responsibility lies on the construction and evaluation of technology.</td>
</tr>
<tr>
<td>6</td>
<td>Theory building (Gregor &amp; Jones 2007)</td>
<td>Paradigm-6: Research is represented by its objectives and methods, whereby the objectives require a multi-methodological approach to integrate theory building and system development.</td>
</tr>
</tbody>
</table>

The first difference between DSR as an approach and a paradigm, is the historical root of DSR (Approach-1) versus its solution space (Paradigm-1). Thereby, DSR as an approach focuses on the problem and its solution itself, whereby DSR as a paradigm describes different possible ways to develop a usable IT artefact. A related difference concerns the underlying kernel theories of DSR. On the one hand, the kernel theories influencing and are influenced by the requirements of the IT artefact (Approach-2) and, on the other hand, the kernel theories are part of the IS design theory which provides a paradigmatic way to conduct and evaluate DSR projects (Paradigm-2). The next characteristic differentiates DSR in an approach and in a paradigm in terms of the design as a product and process. In other words, design is both a verb and a noun. The relevant end product of a DSR approach is the IT artefact itself in form of a construct, method, model, instantiation or a combination thereof. The IT artefact depicts the major contribution to the knowledge base (Approach-3). The paradigmatic view is given by the design process of the IT artefact. Thereby, this design process inhibits a circular process of refinement and improvement of the IT artefact. The IT artefact is not naturally occurring and has to be developed and evaluated (Paradigm-3). Another difference results directly from the prior mentioned one. The evaluation of the IT artefact can be seen from two different points of view. On the one hand, the evaluation of the IT artefact has to be conducted to ensure that the involved stakeholders are satisfied with the created solution. In addition, this solution solves the real-world problem. To ensure this goal, specific evaluation methods can be used (Approach-4). On the other hand, the evaluation can be conducted on a higher conceptual level of abstraction. It can inhibit methods from different paradigms, e.g. interpretative or positivistic, which involves the activities of special experts in the field. Thereby, the evaluation is generalized to a paradigmatic view (Paradigm-4). Another difference is the developmentalist character of DSR. DSR is just one approach to develop IT artefacts. Possible other approaches exist that can also lead to a satisfying solution from a practical point of view, e.g. action research (Approach-5). In contrast, DSR depicts an own and independent paradigm that is called: developmentalist paradigm and exists in harmony with the other paradigms (Paradigm-5). Finally, DSR as an approach provides the basis for theorizing the IT artefact and to generalize the solution and its insights with the help of the theory of design and action (Approach-6).
However, DSR as a paradigm is represented by its objectives and methods and requires a multi methodological approach to enhance the full theoretical value. Hence, it is described in an own paradigmatic point of view (Paradigm-6).

5 CHARACTERISTICS OF DESIGN SCIENCE RESEARCH AS A RESEARCH APPROACH

In this section, we detail how the prior mentioned DSR characteristics are defined by using DSR as a research approach. In particular, DSR has its roots in the architecture and engineering discipline (Simon 1996). Hence, DSR attempts to create things that serve human purposes as well as create utility for the stakeholders (March & Smith 1995). Scientists, using the DSR approach, build IT artefacts to consider the relevance of the IT artefact for business requirements but also to ensure a rigorous research approach. In this context, DSR researchers aim to define a problem solution from a theoretical and practical perspective (Au 2001, Hevner, et al. 2004). From this point of view, DSR can be seen as another research approach to solve practically relevant problems (McKay & Marshall 2005).

In summary, we derive the following characteristics of a DSR approach:

Approach-1: DSR has its roots in the engineering discipline and aims to define a problem solution.

The creation of IT artefacts, which will be described in detail in the following characteristics, rely on existing kernel theories that are applied, tested, modified, and extended through the experience, creativity, intuition, and problem solving capabilities of the researcher. Thereby, kernel theories are derived from natural or social sciences governing the design requirements (Markus et al. 2002, Walls, et al. 1992). In particular, they are influenced and influencing the requirements of the IT artefact and therewith the problem solution. Thereby, kernel theories enable the development of empirical testable predictions relating the design outcome to the system-requirements (Markus, et al. 2002). As a result, DSR is both developing new solutions of IT artefacts to existing but unsolved problems and matching solutions to new and unsolved problems (Holmström, et al. 2009). As an example, a social science theory may be a kernel theory in design. Hereby, the description of user characteristics for the design of an IT artefact should be taken into account (Weedman 2008).

In summary, we derive the following characteristics of a DSR approach:

Approach-2: The underlying kernel theories of a DSR approach are influenced and influencing the requirements of the IT artefact and therewith the problem solution.

The focal research attention in DSR is given by the ‘design of artificial’ artefacts (i.e., IT artefacts) and the creation of something new that does not exist before. Hence, design is both a process (set of activities) of ‘creating something new’ and a product (IT artefact). Defining DSR as an approach we focus on the end products of the design. The relevant end products of DSR are real world problem solutions, e.g. IT artefacts. Thereby, different types of end products have been identified in the literature. The relevant end products are either constructs, models, methods, instantiations, or a combination thereof (March & Smith 1995). This categorization can serve as a guideline by measuring the utility and overall quality of the designed IT artefact to solve the problem at hand. The constructs can be seen as the vocabulary of a domain. They constitute a conceptualization to describe problems within the domain to specify their solution. Analyzing relationships between constructs form the basis for the development of models. Models are sets of propositions or statements that depict these relationships among constructs. Thereby, models represent situations as problem and solution statements. Moreover, with such a real-world representation, new constructs can be created or old ones can be improved. A method is a set of steps (algorithm or guideline) to solve a defined problem. More precisely, a method is a formal implementation of constructs as well as models and at the same time a representation of the solution space. Finally, the instantiation is the realization of an IT artefact in its environment. Thereby, the IT artefact can consist of either specific information systems or tools that address different aspects of designing information systems.
In summary, we derive the following characteristics of a DSR approach:

**Approach-3:** The relevant end products of a DSR approach are IT artefacts. They are either constructs, methods, models, instantiations, or a combination thereof. Thereby, they provide real-world outcomes and not an overall description of the world.

DSR inhibits a creative design process of build and evaluate, which is called the design cycle (Takeda et al. 1990). The evaluation of the IT artefact depicts a major contribution of DSR. After the development of an IT artefact and answering the question if it works or not the evaluation phase follows. In this phase the question how well the IT artefact works is answered and evaluated. Moreover, this phase is realized by the development of metrics and the measurement of IT artefacts according to those metrics (March & Smith 1995, Walls, et al. 1992). This evaluation provides feedback and a better understanding of the problem to improve the quality of the IT artefact and the design process itself (Hevner, et al. 2004). Hevner et al. (2004) provide 5 different evaluation methods (observational, analytical, experimental, testing, and descriptive) in order to meet this goals.

In summary, we derive the following characteristics of a DSR approach:

**Approach-4:** The evaluation part of the DSR approach is finished when the IT artefact satisfies the requirements of the involved stakeholders and solves the relevant real-world problem.

As mentioned before, DSR has been combined in the past with action research (e.g., Allen, et al. 2000, Sein, et al. 2011) in order to enhance the value and theoretical contribution of these projects. Other researchers combined DSR with behavioural science (e.g., Goldkuhl 2004, Holmström, et al. 2009) in order to create a theoretical contribution to the domain of study. Goldkuhl (2004) offers an approach how to use techniques of behavioural science in a DSR project. He presents three different types of grounding: internal, empirical, and theoretical, that can enhance a DSR project to generate grounded practical knowledge. Another study finds that both research strategies complement each other well (Holmström, et al. 2009). In particular, Holmström et al. (2009) develop a framework how DSR as an exploratory research approach can be complemented by a second research cycle including the development of substantive and formal theory in order to make a contribution to the knowledge base besides focusing entirely on the problem solution and the IT artefact.

Thus, we derive the following characteristics of a DSR approach:

**Approach-5:** DSR is one possibility to develop and implement IT artefacts as well as a theoretical contribution. Other research approaches can lead to similar goals.

IT artefacts can be created and developed from kernel theories using a DSR approach. Thereby the IT artefact is theorized to contribute to the existing knowledge base (Carroll & Kellogg 1989, Orlikowski & Iacono 2001). In contrast, IS development by itself is quite a practical discipline and does not necessarily need research (Gregg, et al. 2001, Mantei & Teorey 1989, Nunamaker et al. 1991). However, a theory of design and action can be established by the development of an IT artefact (Gregor 2006). This theory presents the principles of form and function, methods, and justificatory theoretical knowledge that is used in the development process of the IT artefact (Gregor 2006). According to Gregor (2006) the theory-building part of DSR (the theory for design and action) consists in harmony with other theories in the field, e.g., theory for predicting or theory for explaining. The main criteria’s for a contribution to the knowledge base are the utility to a community of users, the novelty of the IT artefact, and the persuasiveness that the IT artefact will be effective (Hevner, et al. 2004, March & Smith 1995). In addition, other contributions can be: the ease of use, the quality of results, or the simplicity (Hevner, et al. 2004, March & Smith 1995).

In summary, we derive the following characteristics of a DSR approach:

**Approach-6:** The DSR approach provides the basis for theorizing the IT artefact and thereby to generalize the context specific solution and to contribute to the existing knowledge base.
In this section, we detail how the prior mentioned DSR characteristics are defined by using DSR as a research paradigm. For instance, any given problem can be framed and solved in multiple ways (Holmström, et al. 2009). The first step in solving a problem is to frame the problem and develop the rudiments of a potential solution design. In this step the researcher has not to discover only a symptom of the problem, because a symptom does not equal a problem. In general, how a problem is solved, depends on the researcher’s point of view. Thereby, abductive reasoning is used in the scientific discovery and problem solving process (Holmström, et al. 2009, Kuechler & Vaishnavi 2008). Hereby, one major aspect of DSR is that it covers both, a process of developing new solutions to existing problems and matching existing solutions to new problems (Holmström, et al. 2009).

In summary, we derive the following characteristics of a DSR paradigm:

Paradigm-1: DSR is both, a process of developing new solutions to existing problems and matching existing solutions to new problems.

Gregor and Jones (2007) provide eight major components that an IS design theory should include constructive to the components of Walls et al. (1992). For instance, the purpose and scope component represents a set of meta-requirements or goals that specifies the scope, or boundaries, of the theory. Another example is given by the artefact mutability component which defines what degree of artefact change is encompassed by the design theory. This two and the remaining six components demonstrate that DSR reflects to IS design theories and thereby provides an underlying kernel theory. As a consequence, DSR can be evaluated or conducted with the help of these components. A research paradigm needs such a conceptual framework for the organized study of the world that has to be explored (Filstead 1979).

In summary, we derive the following characteristics of a DSR paradigm:

Paradigm-2: DSR reflects to IS design theory components and thereby forms a conceptual framework for the organized study of the world.

As mentioned before, a major research attention in DSR is presented by the creation of something new that does not exist before. This design of the newness is a process (set of activities) and a product (IT artefact). Defining DSR as a paradigm we focus on the design process. Thereby, processes are distinguished into two basic elements: the building and evaluation of the IT artefact (Baskerville et al. 2009, Hevner & March 2003, March & Smith 1995). Building an IT artefact is a sequence of activities to produce ‘something new’; an innovative product that solves a real world problem. The evaluation of an IT artefact provides feedback to the design process and generates new knowledge about the problem at hand. The newly generated insights serve to improve both the quality of the IT artefact and the design process itself (Hevner, et al. 2004). The build and evaluate elements are conducted partly in parallel and involve multiple iterations. Through these multiple iterations, the IT artefact is fully generated to the satisfaction of the researchers and practitioners that later make use of it (Markus, et al. 2002). Thereby, IT artefacts are not naturally occurring and always embedded in some place, time and community (Orlikowski & Iacono 2001). DSR focuses on IT artefacts which are encompassing implementations, algorithms, mathematical equations etc. (Alter 2008, Benbasat & Zmund 2003, Hevner, et al. 2004). In addition, the focus of an IT artefact lies on the problem itself. It is finished when it satisfies the requirements of all stakeholders and solves the relevant problem. In summary, DSR creates utility and a meaningful contribution to practice (Hevner, et al. 2004, March & Smith 1995, McKay & Marshall 2005, Walls, et al. 1992).
Thus, we derive the following characteristics of a DSR paradigm:

Paradigm-3: The design process of DSR is distinguished into the building and evaluation of the IT artefact. Thereby, a feedback loop ensures the refinement of the design process. Moreover, the IT artefact is not naturally occurring and always embedded in some place, time, and community.

The creation of an IT artefact focuses on the problem itself. It is finished when it satisfies the requirements of all involved stakeholders and solves the relevant problem. On the one hand, it is necessary to understand why an IT artefact works or does not work while, on the other hand, it is necessary to understand how the IT artefact was created (Hevner, et al. 2004).

The evaluation of an IT artefact is a loop of expert activities for the improvement of underlying theories that lead to an implemented IT artefact (Hevner, et al. 2004). The IT artefact is evaluated to ensure that the requirements are satisfied. Moreover, the evaluation provides feedback to the design process (Markus, et al. 2002, Walls, et al. 1992). Thereby ‘experimental’ (simulation) and ‘testing’ (Black Box) evaluating methods can be conducted in the creation process (Hevner, et al. 2004). However, the evaluation is not limited to a special method and can be conducted in a technical and therewith developmental, in a positivistic, or in an interpretive manner. This example shows the full potential of DSR to combine the advantages of different paradigms. For instance, according to McKay and Marshall (2005), DSR has ‘not to put […] in a positivistic box in which all elements of interest are perfectly and immutably defined […]’. DSR can also be conducted in a developmental manner by focusing on the creation part, or in an interpretive manner by generating theory of the created IT artefact and its usage. In particular, IT artefacts enable DSR researchers to understand the addressed problem and the feasibility of the approach to its solution (Hevner, et al. 2004).

In summary, we derive the following characteristics of a DSR paradigm:

Paradigm-4: The evaluation part can be conducted in a technical, interpretative, or in a positivistic manner and thereby combines the advantages of different paradigms.

Among others the most important paradigms are the interpretative, positivistic, and critical one:

The supporters of the interpretive paradigm see the world as a social process (Orlikowski & Baroudi 1991). Social systems cannot be regarded independently and without the influence of their members. Individuals, organizations, or groups construct the social systems because every user has special requirements that must be addressed by the system. These researchers seek to understand and interpret the social process. The methodologies used in this paradigm are mainly qualitative research and the exposure of special sets of constructs to social effects (Gregg, et al. 2001, Lincoln & Guba 2000, Orlikowski & Baroudi 1991).

The positivistic paradigm is the leading philosophical strand in today’s IS research (Goles & Hirschheim 2000, Orlikowski & Baroudi 1991). This paradigm is primarily based on an empirical world-view seeking to obtain knowledge through quantitative methods. The reason for this procedure is the notion that reality is existent only in one reality (Gregg, et al. 2001). This reality is not disrupted by the action of humans, and social worlds are not influenced by the actions of their members. It consists of a social world that is controlled by nature and thus can be regarded analogous to the natural world. The research efforts are independent from the analyzed object. Hence, the researcher plays only a passive role (Lincoln & Guba 2000, Orlikowski & Baroudi 1991).

In contrast to the positivist and interpretive research paradigms which are predicting or explaining the status quo (Myers & Klein 2011, Orlikowski & Baroudi 1991), the critical paradigm takes a critical position towards established assumptions about organizations and information systems. In addition, its aim is to critique the status quo “through the exposure of what are believed to be deep-seated, structural contradictions within social systems” (Orlikowski & Baroudi 1991, p. 6). The major assumption of the critical paradigm is that people can change their material and social circumstances. However, this change is alleviated by prevailing systems of economic, political, and cultural authority.
which lead to conflicts. These conflicts lead to the need of new social forms and a belief that knowledge is grounded in historical practices (Myers & Klein 2011, Orlikowski & Baroudi 1991).

Gregg et al. (2001) as well as Van Aken (2004) recommended to introduce another paradigm that exists in harmony with the other ones. This paradigm is called the socio-technologist or developmentalist paradigm and is able to give an answer to the demanded theoretical contribution of DSR outcomes. In most other cases the technology and development of IT artefacts is seen as a value which is present or not. In this paradigm, a high responsibility lies on the construction and evaluation phase of technology and IT artefacts. Hence, when the IT artefact is missing some important issues within the environment cannot be solved and the solution has no utility. The socio-technologist or developmentalist paradigm focuses on the creation of technology and the technology itself to affect individual and organizational experience through its utility in a positive manner. Moreover, the IS environment can be seen as a social implemented system. According to Gregg et al. (2001), this paradigm is equivalent with DSR because of its developmental nature.

In summary, we derive the following characteristics of a DSR paradigm:

Paradigm-5: DSR depicts a further paradigm that exists in harmony with the other ones. In this developmentalist paradigm, a high responsibility lies on the construction and evaluation of technology.

IS research is represented by its objectives and methods, whereby the objectives require a multi methodological approach to integrate theory building, system development, and experimentation (Nunamaker, et al. 1991). In contrast, IS development is defined as ‘the art of building software’ but also as the cornerstone for research methodology (Nunamaker, et al. 1991). Subsequently, the research methodologies can be subdivided and classified as part of a certain research paradigm. However, the following classification should not be seen as a strict partition of the methods, but rather as a guideline to understand their differences. In general, paradigms and their methods have no sharp borders; they are flexible and integrative respectively contiguous (Burrell & Morgan 1979, Kuhn 1977, Lincoln & Guba 2000).

The most theoretical perception is the ‘formulative and verificational research’ according to Nunmaker et al. (1991). Its goal is to gain insights and improve the understanding of the problem area. ‘Basic and applied research’ develops and tests for theoretical goals/ reasons, theories and hypotheses. These two perceptions are combined in the interpretive paradigm (Gregg, et al. 2001).

The ‘development’ perception represents the most practical methodology. According to Nunmaker et al. (1991), it provides ‘the systematic use of scientific knowledge’ to build, evaluate and develop new technologies or prototypes. Whereby, it is not only determined to the creation process but also it ‘improves the effectiveness and efficiency of processes at the individual and organizational level’ (Gregg, et al. 2001). The ‘evaluative and development research’ is located closely to the ‘development’ and includes both: the evaluative (more theoretical) and the developmental (more practical) approach. Both form the socio-technologist or developmentalist paradigm (Gregg, et al. 2001).

The ‘scientific and engineering research’ represents the connection between the theoretical and practical approaches together with linking perceptions, such as ‘basic and applied research’ and ‘evaluative and development research’ are represented by the positivist or post positivist paradigm.

In summary, we derive the following characteristics of a DSR paradigm:

Paradigm-6: Research is represented by its objectives and methods, whereby the objectives require a multi methodological approach to integrate theory building and system development.
7 SUMMARY AND OUTLOOK

In this paper we compared two perceptions: DSR as an approach and DSR as a paradigm by identifying six basic DSR characteristics. Thereby, we stimulate a scholarly debate about these characteristics and their differences related to DSR as an approach and paradigm. Both perceptions are already discussed in the literature but not faced with each other. In our comparison we identified these six characteristics and thereby present that there are obvious differences between them. While prior research defined DSR as an approach or as a paradigm (Gregg, et al. 2001, Hevner, et al. 2004, McKay & Marshall 2005, Niehaves 2007), this paper systematically compares the two perceptions and provides researchers guidance for an appropriate use of DSR.

The implications of our research are that DSR serves the demand about rigorous and relevant research but is still not a fully accepted research approach or independent paradigm. The result of our comparison suggests that there are some salient differences between DSR as an approach and DSR as a paradigm. For example, the major goal of DSR is to build and evaluate IT artefacts to solve a real world problem (Hevner, et al. 2004). Building an IT artefact reflects directly to the socio-technologist or developmentalist paradigm. In this context, some scholars argue that DSR is rather a paradigm than an approach (e.g., Gregg, et al. 2001, Iivari 2007, Van Aken 2004). However, the building phase of an IT artefact may reflect to the developmentalist paradigm but not necessarily the evaluation part of the IT artefact. The evaluation can also be conducted in an interpretive way by generating theory of the created IT artefact (Holmström, et al. 2009, Weedman 2008) or in a positivistic way. One of the strongest arguments for DSR as an approach is that DSR can be combined with other approaches, e.g., action research (e.g., Allen, et al. 2000, Sein, et al. 2011), ethnography (e.g., Baskerville & Stage 2001), or soft design science (Baskerville, et al. 2009). Combining different approaches may enable researchers to use a more pluralistic research approach across paradigm boundaries (Burrell & Morgan 1979, Kuhn 1977, Lincoln & Guba 2000). Hence, DSR could be seen as an own paradigm but rather is on its way to a pluralistic research approach that integrates tools and methods from different paradigms.

The limitation of this paper is that the six characteristics were derived from the reviewing process of the extant DSR literature starting at Hevner et al.'s (2004, p. 80) framework for information systems research. We cannot guarantee for completeness but hope to stimulate a scholarly debate about this topic in our paper. However, independent of its classification, DSR satisfies the demand for more pluralistic research (Mingers 2001) and in the end ensures a theoretical contribution to the domain of study.

References


