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Multi-Paradigmatic Theorizing: Mixing Design and Exploration

Completed Research

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Abstract

Design science research is becoming a major area in the IS discipline. Despite the growing popularity of DSR in IS, there is a lack of established guidance on how to conduct this type of research. Moreover, although DSR is considered a pluralistic area of research, few studies have proposed multi-paradigmatic methods for DSR. The current study suggests a new framework for theory development in DSR. The proposed framework integrates the previous DSR methodologies and differentiates between four components: design, design theorizing, explanatory theorizing, and data collection. A pluralist approach that integrates existing DSR components by coupling design and exploration, generating new knowledge (design theories) that can inform future representations is leveraged. This study steps outside the conventional theory development in DSR through employing a pluralistic perspective. We illustrate the framework with empirical research in the context of open strategic planning.

Keywords

Design Science Research, Information System Design Theory, Grounded Theory, Pluralist Research.

1. Introduction

Recently, there have been high profile calls to integrate various strands of Information Systems (IS) research to profit from their complementary perspectives (Goes 2013). Our paper answers these calls by joining two prolific areas in IS, design science research and qualitative research that uses grounded theory. Thus far, despite the growing popularity of both approaches, they have been considered separately.

Design science research (DSR) is becoming a major area in IS discipline (Gregor and Hevner 2013). DSR promises a unique perspective on addressing concrete practical problems through building innovative systems – information technology artifacts. DSR also seeks to create knowledge through design, development, and analysis of innovative artifacts in different formats (such as software, computer systems, algorithms, and methodologies) (Amrollahi et al. 2014b). The *research* element in DSR is an integral component referring to the creation of knowledge during the design process. Notably, the data produced during the design process are valuable sources for various types of research including theory development research (Gregor and Jones 2007). The theory generated during design research can be of *design and action* (prescriptive) type concerning achieving an objective via principles of form and function, methods, as well as justificatory theoretical knowledge for the development of IS (Gregor 2006). DSR data can also generate additional data to be analyzed with inductive approaches and produce explanatory insights about the phenomena (Beck et al. 2012).

Information System Design Theory (ISDT) development is known as a method of developing prescriptive theory in DSR. This type of theory focuses on both specifications of the artifact and the procedure to design the artifact—based on a set of kernel theories derived from natural or social sciences (Gregor and Jones 2007; Walls et al. 2004). The primary goals of ISDT are identified as: (1) developing a methodology; and (2) developing a product (Gregor and Jones 2007). Much of ISDT focuses on the 'how' [we build an artifact] (e.g., by what way or method) while neglecting the 'why' [we build the artifact] (e.g., for what purpose or reason). The former constrains the artifact development to a narrower view that often leaves social entities (e.g. users or organization) outside the scope of the design process. Little guidance is available for developing design theories based on design science research. A symptom of this is the lack of methodological guidelines available on how to develop design theory (Gregor et al. 2013).

Grounded Theory (GT) has been suggested as an alternative approach to generate theory in DSR. GT uses an inductive approach to produce explanatory theories by analyzing data (Beck et al. 2012). This approach provides precision through insights that go beyond just delivering an IT-based solution (Amrollahi and Rowlands 2016a; Beck et al. 2012). However, the limitation of the GT approach is that it focuses more on solving the real-world problem through innovative information technologies rather than on the creation of design and action theories.

This study aims to take advantage of the complementarity of these perspectives in a single pluralistic methodology. We believe ISDT and GT are not isolated from each other and at times struggle to provide a comprehensive solution for the design problem without each other. Therefore, a pluralistic method of design research is proposed in which ISDT and GT play a complementary role. The proposed method focuses on various types of data collected during the design process and suggests different exploration approaches for integrating both prescriptive and explanatory theories. This pluralistic perspective is beneficial for DSR as it considers behavioral interactions between the artifact and environment, considering artifact development as a bundle with social and technical features (Orlikowski and Iacono 2001).

This study contributes to several calls for multi-methodological and multi-paradigmatic pluralism in IS research (Avison and Fitzgerald 2012; Paul 2005). The proposed methodology integrates the previous DSR methodologies (Beck et al. 2012; Peffers et al. 2007; Walls et al. 2004) and differentiates between four components: design, design theorizing, explanatory theorizing, and data collection within the research.

This article is organized as follows. We introduce a typology for theories based on the available literature and discuss epistemological and ontological roots of different types of theories used in the proposed methodology, followed by the notion of research pluralism in IS research. The multi-paradigmatic methodology for theory development is then presented in section three through a combination of four different activities (namely: prescriptive theorizing, design, data collection, and design theorizing). We also briefly present an empirical research that is conducted with the presented approach in section four. Finally, possible contribution and implications of the paper are discussed in section five.

2. Background

The proposed methodology leverages principles of ISDT and GT method to develop a pluralistic methodology. This section briefly introduces the concepts used to develop the methodology and reviews the development of each concept in the related literature: pluralism in information systems research, information system design theory, and grounded theory method.

Paradigmatic pluralism in IS has roots in mixed methods research in social sciences. Cavaye (1996) for example highlighted the employment of positivist and interpretivist perspectives for case study research method in IS research. DSR also attracted the attention in IS pluralistic research. Combining DSR and other paradigms of research was later introduced as another stream of pluralistic IS research (Beck et al. 2012). The nature of DSR is further studied in the literature of epistemological pluralism. Especially Niehaves (2007) who considered DSR as a third paradigm and explained DSR as an area of research adopting diverse research paradigms—ontologically pluralist as it refers to multiple and contextually situated alternative world states (Kuechler and Vaishnavi 2004).

2.1 Pluralistic Methodology for Theory Generation

The proposed method in this study synthesizes four different components. First, it considers the activities required to design an artifact and related knowledge. Second, the method considers prescriptive (design) theory development in line with artifact development. The third component comprises of the different sources of data that can be collected during the design project. Explanatory-grounded theorizing based on the collected data is considered as the fourth component of the methodology. Finally, the study addresses the relationship between different components and how to integrate them as a research methodology. Each component is explained in the following sections.

2.1 Information system design theory

A focal ISDT proposed by Walls et al. (2004) attempts to retrieve a number of meta-requirements from available theories in natural and social science (e.g., kernel theories) and create a design method and process based on these requirements. Walls et al. (2004) also emphasized "instantiation" in arguing that a prototype system based on a design theory should be constructed to permit the propositions of the theory to be tested. ISDT development methodology was later extended and enhanced by Gregor and Jones (2007) through different activities. Finally, Kuechler and Vaishnavi (2012) contributed by introducing the notion of "design relevant explanatory/predictive theories (DREPTs)" to the design theory research. DREPT highlighted an approach to translate the kernel theories in a language that can be used by design theories. All of the above methodologies for ISDT development are however highly relied on a design perspective and less focused on the post implementation conditions and possible improvements in the artifact.

2.3 Grounded theory method

Grounded theory method was introduced by Glaser and Strauss (1967) as an inductive methodology of deriving a theory of human behavior from empirical data. This methodology was later widely spread as a qualitative method in different areas of research including IS. In the field of IS, GT is known to be beneficial based on its potential for in-depth understanding of the research problem and its power to analyze qualitative data (Urquhart et al. 2010). The power of GT method to create context-based and process oriented knowledge in the area of IS (Myers 1997; Rowlands 2005) promoted this method to be used within a range of perspectives. The majority of GT research in IS is however conducted through an interpretivist lens (Hughes and Jones 2003). The only methodology we found to employ a GT approach on the slices of data driven from DSR (Beck et al. 2012) adopted an interpretivist perspective and is less relied on action and design but exploration. Table 1 explains ISDT and GT as the two main strands of theory development in IS research.

Type of theory	ISDT	GT
Source	Kernel theories from different context	Empirical data focused on human behavior
Focus	How to design effectively	To understand the human interactions with the system
Epistemology	Knowledge through making: objectively constrained construction within a context. Iterative circumscription reveals meaning	Subjective, values and knowledge emerge from the researcher-participant interaction
Ontology	Multiple, contextually situated alternative world-states. Socio-technologically enabled	Multiple realities, socially constructed

Table 1 ISDT versus GT partly driven from Kuechler and Vaishnavi (2004)

Reviewing the above concepts motivated the current research to focus on methodological developments for research pluralism and consider how ISDT and GT can complement each other in dealing with design problems.

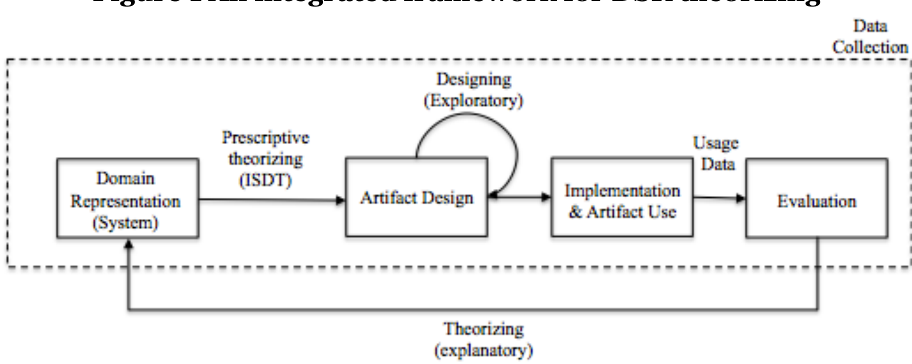
3. Pluralistic Methodology for Theory Generation

When it comes to the role of theory in DSR, Kuechler and Vaishnavi (2012) affirm that theory can be both an input to design (kernel theories, design-relevant explanatory/predictive theories) and an output of design (design theories) (Gregor et al. 2013). A number of IS researchers have called for greater attention to IT artifact in research designs and the greater use of quality design-science designs (Markus et al. 2002; Orlikowski and Iacono 2001). In the current study, we adapt an existing IS component to design research named *domain representation*. In this methodology, creating faithful domain representation is identified as the underlying notion motivating the researchers to conduct the design study. It is different from purpose and scope component proposed in previous studies (Gregor and Jones 2007) as it does not study the purpose of the problem or any type of requirements in detail. In fact, we suggest the domain to form and lead kernel theories (as part of design theorizing) and problem identification (as part of the design process). This could be compared with the "internal grounding" concept suggested by Goldkuhl (2004) to consider values and categories of design knowledge or internal warrants.

3.1 Proposed research framework

The proposed framework in this study synthesizes four components. These components are integrated with existing DSR frameworks as shown in Figure 1. The boxes represent components from existing IS literature. For example, the domain representation reflects the idea of an artifact as a representation of the real world (Burton-Jones and Grange 2012; Lukyanenko et al. 2014). Our focus, however, is in leveraging a multi-paradigmatic approach (represented as arrows) to relate existing DSR components together through by coupling design and exploration, generating new knowledge (e.g., design theories) that can inform future representations. The first component we emphasize considering the activities required to design an artifact and related knowledge. The second component considers prescriptive (design) theory development and artifact development. The third component comprises of the different sources of data that can be collected throughout the design project. The fourth component refers to explanatory-grounded theorizing based on the collected data. Finally, the study addresses the relationship between different components and how to integrate them as a research methodology. Each component is explained in the following sections.

Figure 1 An integrated framework for DSR theorizing



3.2 Framework activities

The current section explains how different components of the proposed methodology are related to each other in terms of various types of data transferred between different activities. We propose the following four components as possible components of DSR: artifact design, prescriptive theorizing, data collection, and explanatory theorizing. We claim that these components cannot provide a fully comprehensive solution for design problem unless they are integrated together. In the current section, the proposed components of the methodology are integrated through different types of explanation.

Domain representation: the information systems (IS) field is increasingly represented as a discipline that is concerned with the design, construction, and use of artifacts based on information technology (IT). A *representation* is the essence of all information systems (Kent 1978; Rai 2017). By observing the behavior of these IS artifacts, we obviate the need to observe the behavior of the system it represents. Representation theory suggests that an IS artifact is comprised of several structures that serve to represent a domain. Representations allow individuals to understand the state of real-world systems relevant to them (Wand and Weber 1995). As Burton-Jones and Grange (2012) state, such representations can be a state of their mind, a state of their business, or a state of their business environment that enable these individuals to act in the world. These representations of the *world* get translated into IS objects. The challenge remains in creating artifacts that are faithful representations of the world—whether these representations meet the user's needs and enables them to act (Burton-Jones and Grange 2012; Lukyanenko et al. 2014; Weber 1997).

Implementation and artifact use: designing, building, and implementing artifacts are not independent of their use (within a social context). Here, we assume that the business needs and the IT artifact are aligned to solving the needs of the organization and that users adopt the artifact created—there are no misfits in the design and implementation of such artifact (Rosemann et al. 2004). Effective use refers to the use of an artifact in a way that helps attain a relevant (objective) goal (Burton-Jones and Grange 2012).

3.2.1 Artifact design

The essential and indispensable element in all types of DSR is *designing an artifact*. This part of the research methodology deals with the process of creating a new artifact that does not exist to address some real-world problem (Hevner et al. 2004). This process is of interest in DSR when the design process is innovative (Kuechler and Vaishnavi 2004). Although a variety of design contributions have been considered during more than two decades of DSR (Amrollahi et al. 2014b; Lukyanenko and Darcy 2016), the design component is considered in all forms of DSR. Not different from other DSR methods, the current study considers design activities as an essential component of the proposed methodology. The design activities in the proposed methodology lead other activities and differentiate it with other types of theory development studies. It also identifies the points of data collection and provides an approach to implement the developed theory and evaluate it in a real-world environment. Finally, designing a new, innovative, and useful artifact motivates stakeholders (especially in an organizational setting) to devote their time and resources to the research project.

A number of process models and methodologies have been proposed to lead the design process. Among them, the process model suggested by Peffers et al. (2007) is selected as the design component. We believe the design process is triggered by a domain or idea and that helps the design team to identify research problem and motive. The process continues with defining objectives of a solution. This solution will be converted to an artifact (e.g., design method or design principles) during design and development phase. The developed artifact will be then demonstrated in a *valid instantiation* (Lukyanenko et al. 2014; 2015), which is then evaluated to demonstrate how effective the designed artifact is in achieving its identified objectives. Finally, the knowledge gained is disseminated in the communication phase.

3.2.2 Prescriptive theorizing

The second component in the proposed methodology is a prescriptive (design) theory. This theory is of the design and action type and focuses on suggesting an approach to do something in terms of both describing the form and function and the process of design (Gregor 2006; Gregor and Jones 2007). Design theory is considered in the proposed methodology to develop prescriptive knowledge. Considering this component in the methodology will improve the comprehensiveness of the methodology and enables the methodology to produce "how to" knowledge when implemented.

The current study refers to the proposed method by Walls et al. (2004) for the ISDT development component. This component also starts with a new domain and this innovative domain, helps the research to consider kernel theories from social and natural science. The kernel theories help the research to identify a number of meta-requirements or the purpose and scope of design (Gregor and Jones 2007). These meta-requirements are used to describe a class of artifacts hypothesized to meet the metarequirement (meta-design) and a description of the procedure to construct artifact (design method). Finally, the prescriptive theorizing component ends in a number of testable hypotheses to test whether the meta-design and design method can satisfy the identified meta-requirements.

3.2.3 Data Collection

DSR creates a potential for data collection that can later be utilized for the purpose of theorizing and verification. Data collection in DSR is typically conducted to evaluate the relevance and utility of an artifact and/or the design theory. According to the literature, there are several points (such as problem evaluation, ex-ante evaluation, observations, and ex-post evaluation) in which there is a potential for data collection during the process of design research (Abraham et al. 2014; Eriksson et al. 2011; Siau and Rossi 2011). We thus explicitly suggest leveraging this stage to obtain data needed for our method throughout the project. Table 2 lists different types of data that can be potentially collected during different stages of the design project. Based on this, various phases of data collection are identified.

Table 2 Types of data produced during a design research

Data collection phase	Data type	Sources of data	Reference
Problem identification	Informal experience based insights	Interview, archival data	(Beck et al. 2012; Kuechler and Vaishnavi 2012)
Ex-ante evaluation	Positivist / reductionist	Static analysis	(Hevner et al. 2004; Pries-Heje et al. 2008; Venable et al. 2014)
	Hermeneutic	Portfolios, balanced scorecard	(Pries-Heje et al. 2008; Venable et al. 2014)
Design team observations	Pre-design observations	Prototype, pilot study	(Ngai et al. 2009)
	Design observations	Design notes, formative evaluation during design	(Sein et al. 2011)
	Implementation observations	Formative evaluation during implementation	(Beck et al. 2012; Ngai et al. 2009; Sein et al. 2011)
Ex-post evaluation (artifact)	Automatic	Experiments, proof-of-concept, statistics, simulation, functional testing	(Hevner et al. 2004; Kuechler and Vaishnavi 2012; Mettler et al. 2014; Peffers et al. 2007; Pries-Heje et al. 2008; Venable 2006)
	Human subjects	Interview, questionnaire, informed argument	(Beck et al. 2012; Hevner et al. 2004; Kuechler and Vaishnavi 2008; Pries-Heje et al. 2008; Venable 2006)
Ex-post evaluation (theory)	Survey	Interview, archival records, discourse	(Aier et al. 2011)

3.2.4 Explanatory theorizing

More than explaining "how to develop" an artifact, the current methodology suggests an approach to develop an explanatory theory. This type of theory is focused on answering "why a component is considered in an artifact" (Baskerville and Pries-Heje 2010) and we believe in the long term it can lead to provide an answer to the question "how to [effectively] use" the artifact after justifying why each component is considered in the artefact.

In the current study, we adopt a method of theorizing proposed by Beck et al. (2012) employing the principles of grounded theory method to generate theory in DSR. The method basically considers the five steps of DSR (awareness of problem, suggestion, development, evaluation, and conclusion) in the literature (Kuechler and Vaishnavi 2004; Purao 2002) and consider a new phase of "theory generation" after evaluation through "slices of data" collected during the design research.

The explanatory theorizing component in the current study, like other components, starts with referring to a domain based on that theoretical sampling is conducted on available slices of data resulting in a tentative design for the system. This will continue after development and evaluation of the artifact with extra pieces of data collected and open coding and axial coding are performed on data. The open coding process involves condensing data to identify significant themes and finding abstract representations for it (Corbin and Strauss 1990) and axial coding mainly focused on relating the codes (from open coding) together (Gasson and Waters 2013). Data collection will be stopped when little new evidence was being obtained, a situation known as theoretical saturation (Shiau and George 2014).

4. Illustration of the proposed method

In order to show how the proposed method can be used by other researchers, we consider the example of using a pluralist method in IS research. This study focuses on the recent concept of open strategic planning (OSP) – an approach to strategic planning that leverages open innovation (e.g., via crowdsourcing, see Lukyanenko et al. 2017). At the time of conducting the research, the concept of OSP was just gaining maturity in spite of dispersed research and case studies on this area (Amrollahi et al. 2014a; Amrollahi and Rowlands 2016b), two main gaps in the body of literature were recognizable: (i) How to implement the concept of OSP in an organizational setting?; and (ii) the social, political, technological, and organizational factors impacting the effectiveness of an OSP approach.

To answer these questions a pluralistic design approach was employed. To do this, the concept of OSP was selected as *the domain* in the methodology and a planning system was designed and implemented in two cases. The main objective of the planning system was set as converting a number of strategy ideas from stakeholders to a strategic plan. The designed system was then implemented in both cases. The development of the strategic plan took almost two months and the strategic plan was developed through the contribution of almost 100 stakeholders in each case.

Different approaches of data collection were utilized during and after the implementation of the artifact. The main source of data was a set of interviews with different stakeholder groups administered after the development and publication of the strategic plan in each case. These interviews were aimed at ex-post evaluation of both artifact and theory. In addition to the interviews, the primary meetings and discussions with managers in both cases were also documented. Design notes and design team observations were coded and documented for future analysis. These observations included ex-ante evaluation of the developed system versus a number of technical criteria.

Parallel to the design process and based on kernel theories, a prescriptive theory was also developed, tested, and refined in both cases. Referring to the OSP concept, there was a need to select a theoretical basis to satisfy both process requirements for developing a strategic planning and requirements in relation to the system and its interaction with users and stakeholders. For this reason, two different kernel theories have been adopted in this study. First, Habermas's theory of discourse (Habermas 1990) is selected as a macro level kernel theory to consider strategy discourse within the OSP methodology. Second, Bryson's strategy change cycle (Bryson 2011) is set as kernel theory to prescribe a process view for OSP.

Based on the kernel theories, seven requirements were identified dealing with the properties of the planning system and planning process. These requirements were identified in a reciprocal relationship with the objectives of design. Based on these requirements an abstract blueprint of the planning information system was identified as meta-design. This architecture covered eight modules (user management, stakeholder attraction, idea capturing, idea refinement, reporting, plan publication, implementation, and workflow engine). Moreover, a four steps process of OSP was identified as design method to direct the OSP process from beginning to end. Finally, three propositions were identified reflecting the knowledge acquired during the design process. The propositions explain the conditions through which a methodology for OSP can be effective.

The research was not stopped after answering the question of "how to". Instead, the study investigated the factors impacting OSP effectiveness. This component of research again started with the domain of OSP and an initial theoretical sampling conducted based on the results of primary discussions with managers in both case studies. The process continued with the analysis of data collected during the design process (observations) and interviews. The collected data was first analyzed through condensing data to identify significant themes and finding abstract representations (open coding). This process started after the first interview and continued during the data collection, resulting in a final set of 10 codes. Data analysis then continued with axial coding or relating the open codes together. This component of the research ended in proposing eight propositions on the effectiveness of the OSP method.

Employing a multi-method and multi-paradigmatic enabled the study to develop a comprehensive view on the novel concept of OSP. The research had the potential to help the practitioners both before and after employing an OSP method. It also resulted in producing knowledge on how to develop similar OSP systems and explanatory knowledge on how to operate such systems.

5. Discussion and Conclusion

Despite the growing popularity of DSR in IS, there is a lack of established guidance on how to conduct this type of research. Moreover, although DSR is considered a pluralistic area of research, few studies have proposed multi-paradigmatic methods for DSR. Considering different paradigms can improve the comprehensiveness of research and letting the researchers study a single problem from different perspectives (Doherty and Terry 2009).

We found several shortcomings with existing work suggesting methods for developing design theories. First of all, although the components of a design theory are identified in the literature (Gregor and Jones 2007; Kuechler and Vaishnavi 2012; Walls et al. 2004), explicit (and step by step) guidelines to develop such theories are missing. Especially, when it comes to the sources of data used to development of the theory. The proposed methodology addressed this shortcoming by mentioning the reciprocal relationships between design theorizing, design process, and data collection process.

We also contribute to the literature on design theory. There are few studies suggesting conceptual or heuristic approaches for evaluation of the design theory (Aier et al. 2011; Mandviwalla 2015). These approaches, however, remain isolated from the development process. The proposed methodology also addressed this shortcoming in the ISDT literature by suggesting ex-ante evaluation as part of the proposed methodology. The literature on the development of design theory has also made little effort to clarify the epistemological status and thus the space of possibilities for DSR (Gregor and Jones 2007). The proposed study, however, particularly focuses on epistemological issues and differentiates epistemological perspectives to answer different aspects of a research problem.

Finally, the actual use of an artifact is usually ignored in ISDT as a result of focusing on how to build the artifact. Moreover, stakeholders interpretations of an artifact or the method to develop it are less considered in ISDT studies. The proposed methodology responded to this shortcoming by suggesting an explanatory theorizing component in the methodology. This component employs an inductive lens to analyze the collected data during design research and proposes a theory to predict or explain the way the artifact can be used in the most effective way.

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