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Design Science Research in Information Systems: A Critical Realist Perspective

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Abstract

The two major IS design science research schools have a focus on IT artifacts and have very little discussions regarding underpinning philosophies. We present a framework for IS design science research underpinned by the philosophy of critical realism. We argue that the aim of IS design science research is to develop practical and actionable knowledge for the design and realization of different classes of IS initiatives, where IS are viewed as socio-technical systems. The paper presents how this type of knowledge can be developed as well as the nature of such knowledge.

Keywords

Design science, design science research, information systems research, critical realism

INTRODUCTION

In the last years there has been an intensive debate in the Information Systems (IS) community regarding the "crisis in the IS field"—see, for example, the debates in journals like *MIS Quarterly* and *Communications of the AIS*. Some scholars argue that part of the crisis is related to the utilization and relevance problem (Agarwal & Lucas 2005; Hirschheim & Klein 2003): research not addressing relevant issues and not producing usable results. To increase IS research utilization and relevance it is argued that the mainstream behavioral IS science research should be complemented with more IS design science research (Walls et al. 1992, 2004; March & Smith 1995; Hevner et al. 2004; Purao 2002).

Herbert Simon (1996) in his seminal book "The Sciences of the Artificial" distinguishes between "natural sciences" and "sciences of the artificial." The former focuses on how "things" (natural and social things) are and how they work—for clarity and consistency we will in the rest of the paper use the concept "behavioral science" instead of "natural science". The sciences of the artificial focus on how to design and construct artifacts and artifical systems having desired properties. Simon's work on the sciences of the artificial and design science has influenced IS scholars. We have in the last years seen a growing interest in IS design science research and IS design theory/knowledge (Walls et al. 2004): there is a fairly new ISWorld web-site on "Design Research in Information Systems" (Vaishnavi & Kuechler 2006); the United States National Science Foundation (NSF) issued a solicitation in 2004 with the goal "to stimulate research and education projects that build the Science of Design"; the First International Conference on Design Science in Information Systems and Technology (DESRIST 2006) was held earlier this year and will be followed by DESRIST 2007; and *MIS Quarterly* had earlier this year a call for papers on "Design Science Research." Based on the IS field's utilization and relevance problem it has been suggested that one way to advance the IS field is to increase IS design science research (Hirschheim & Klein 2003; Iiivari 2003). Two major IS design science research schools have emerged (El Sawy 2006): 1) Information Systems Design Theory (Walls et al. 1992, 2004), and 2) Design Science Research (cf. Nunamaker & Chen (1990), March & Smith (1995), Hevner et al. (2004), and Cao et al. (2006)). Two major issues have not been carefully addressed in these two schools.

First, there is too little discussion about what IS design science research should include and what should be excluded. The views in the two schools are that it is IS design theories for different classes of IS (Walls et al.) and IT artifacts (Hevner et al.) that should be developed. We will argue that there is a need for IS design science research to take a broader view on IS and IS design knowledge.

Second, there is no, or little, discussion about underlying philosophical assumptions in the two IS design science research schools. Said Purao: "…the scientific foundations underlying this critical area of the IS field—design research—have remained largely undeveloped. … Over the years, in spite of important writings about research (e.g. March and Smith [1995]), philosophical underpinnings of this form of research have been largely unexplored. Without adequate scientific foundations, research in the technology of information systems (TIS) continues to be a lost child still searching for its scientific home." (Purao 2002). The underlying ontological view an IS design science research framework/school is built on will ultimately affect how to do IS design science research and what types of outcomes (design knowledge) that can be produced. It can be fruitful to develop and explore IS design science research frameworks based on different philosophies, that is, frameworks based on different ontologies and epistemologies—McKay and Marshall (2005) make the same point.

The remainder of the paper is organized as follows: next we review IS design science research schools and elaborate the above two issues. We argue for a broader view on IS design science research and for grounding IS design science research in the philosophy of critical realism. A short presentation of critical realism follows and this is followed by a presentation of an IS design science research framework based on the philosophy of critical realism.

DESIGN SCIENCE RESEARCH IN INFORMATION SYSTEMS

Below, we review the two major IS design research schools by primarily addressing two issues: 1) what is focused in the schools, and 2) what underlying philosophies—for example, ontological and epistemological views—have the schools. The first issue is related to the IS core discussion. The second issue is critical since in all research, including IS design science research, ontology is non-optional (Fleetwood 2004).

As far as we know, the first article on developing IS design theories (ISDT) and IS design knowledge was published in 1992 by Walls et al. (1992). Walls et al. argue that successful construction of ISDT would create an endogenous base for theory in the IS discipline, and could be used by scholars to prescribe design products and processes for different classes of IS as they emerged. The authors build on Simon's distinction and argue that design is both a product and a process, which means that ISDT must have two aspects: one that deals with the design product and one that deals with the design process. Walls et al. use the concept "artifact" quite freely, but in reflecting on their 1992-paper they say: "We did not use the current phrase 'IT artifact', but in essence it was that to which we were referring." (Walls et al. 2004).

Building on Simon's work, March and Smith (1995) argue that design sciences involves building and evaluating: 1) *constructs* which are "concepts with which to … characterize phenomenon", 2) *models* that "describe tasks, situations, or artifacts", 3) *methods* as "ways of performing goal directed activities", and 4) *instantiations* which are "physical implementations intended to perform certain tasks". Hevner et al. (2004), building on March and Smith, present a design science framework and guidelines around building and evaluating IT artifacts. Hevner et al. expressed their view on what constitutes good—rigorous and relevant—IS design science in the form of seven guidelines. The authors contend that each of the guidelines should be addressed in some manner for IS design science research to be complete. Guideline one—"design as an artifact"—states: "Design-science research must produce a viable artifact in the form of a *construct*, a *model*, a *method*, or an *instantiation*." (Hevner et al. 2004, italics added to indicate similarity with March and Smith's view on the output of design science research). And, the "result of design-science research in IS is, by definition, a purposeful IT artifact created to address an important organizational problem. … Our [Hevner et al.'s] definition of IT artifacts is both broader and narrower [than other IT artifact definitions] … It is broader in the sense that we include not only instantiations in our definition of the IT artifact but also the constructs, models, and methods applied in the development and use of information systems. However, it is narrower in the sense that we do not include people or elements of organizations in our definition nor do we explicitly include the process by which such artifacts evolve over time."

Regarding what should be included in an IS design research framework, and consequently in IS design theory and IS design knowledge, it is clear that Walls et al., Nunamaker and Chen, March and Smith, Hevner et al. and Cao et al. focus IT artifacts. They exclude the non-technological context by excluding people and organizations. Given, the schools' focus, and what the exclude, the schools might better be labelled IT design science research schools.

There is a lively debate in the IS-community on what constitutes the "IS core". In the IS design science research literature this debate has until recently been almost non-existing. The above IS design science research schools have views in line with Benbasat and Zmud's (2003) view that the core of the IS discipline and IS research should be the IT artifact. We find this a too narrow view. McKay and Marshall (2005) argue that IS is a sociotechnical discipline and that "… design science and the research that builds that body of knowledge must acknowledge that IS is fundamentally about human activity systems which are usually technologically enabled, implying that the context of ***design*** and ***use*** is critical, and that research paradigms, practices and activities must embrace such a worldview." Venable (2006) argues that the core of IS design science research is "solution technology invention", where "Solution technologies that are relevant in the IS/IT field include IS development methods, techniques, and tools, IS planning methods, IS management methods, IS/IT security and risk management practices, algorithms for computer processing, such as database processing, and many others, all of which are designed purposefully to address human and organisational problems and all of which must be adapted or redesigned when addressing particular, situated problems." In line with McKay and Marshall's and Venable's view we suggest that the aim of design science research in IS is to develop practical knowledge for the design and realization of "IS initiatives" or to be used in the improvement of the performance of existing IS—the latter is excluded by Hevner et al., but seems to be critical for practitioners, see, for example, Bendoly and Jacobs (2005) on strategic extension and use of ERP systems. By an IS initiative we mean the design and implementation of an intervention in a social-technical system where IS (including IT artifacts) are critical means for achieving the desired outcomes of the intervention—hence, design science research in IS includes organizations, people, IS, and IT artifacts.

The second issue we address is the underpinning philosophies and ontologies in design science research in IS. The above IS design science research schools do not explicitly address ontology, but ontology is non-optional in all research (Fleetwood 2004). Although, Walls et al., March and Smith, and Hevner et al. do not address underpinning philosophies and ontologies, it is possible to conclude that their frameworks/models are based in positivism, traditional realism, or pragmatism. This conclusion is based on the few philosophical and philosophy of science references used by the authors and that they use concepts like "prove"; Hevner et al. explicitly refer to pragmatism and Cole et al. state that "..DR [Design Research] is rooted in pragmatism" (Cole et al. 2005). McKay and Marshall (2005) also conclude that most IS design science research is positivistic.

It is noteworthy that the ISWorld web-site on "Design Research in Information Systems" has a section on the "philosophical grounding of design research" (Vaishnavi & Kuechler 2006). Unfortunately, the authors mix concepts and definitions and their use of key concepts are inconsistent with what can be found in the philosophy and philosophy of science literature. For example, they say that "ontological and epistemological viewpoints shift in design research as the project runs through circumscription cycles ... This iteration is similar to but more radical than the hermeneutic processes used in some interpretive research." (ibid.) This means that in IS design science research a researcher's assumptions about how the world is "constructed" should change during a design research project. What the authors probably mean is that our knowledge of the world changes which is quite a different matter. They also make what Bhaskar (1978) calls an "epistemic fallacy" in that they transpose what is an ontological matter—concerning what exists—into an epistemological matter of how to develop reliable knowledge about the world.

To conclude, writings on IS design theory, IS design knowledge, and IS design science research do almost never explicitly discuss ontological issues and underpinning philosophies, but most papers seem to be based in positivism, traditional realism, or pragmatism. This is consistent with the IS field in general, where the overwhelming majority of articles are positivistic (Chen & Hirschheim 2004). Some IS scholars point out weaknesses in positivism, etc., and suggest the use of alternative philosophies (paradigms), like constructivism and theories like structuration theory (ST) or actor network theory (ANT). Using Gregor's (2006) classification of IS theories, it seems that the alternatives can be fruitful for developing IS theory for analyzing, explaining, predicting, and explaining and predicting, but less so for developing theory for design and action (design science research). Said Lyytinen (2005): "I do not find the current implications of these theories [ST and ANT] very reassuring for our understanding of design." This paper articulates a view on IS design science research based on the philosophy of critical realism which is an alternative to positivism as well as to constructivism and theories like ST and ANT.

CRITICAL REALISM

Critical realism (CR) was developed as an alternative to positivism and empiricism and as an alternative to non-positivism, e.g. constructivism and relativism, and to theories like ST and ANT. The most influential writer on critical realism is Roy Bhaskar (1978, 1989, 1998). Clear summaries of critical realism are found in Archer et al. (1998) and Chapter 1 in Bhaskar (2002).

Critical realism can be seen as a specific form of realism: "To be a realist is to assert the existence of some disputed kind of entities such as gravitons, equilibria, utility, class relations and so on. To be a scientific realist is to assert that these entities exist independently of our investigation of them. Such entities, contra the post modernism of rhetoricians, are not something generated in the discourse used in their investigation. Neither are such entities, contra empiricists, restricted to the realm of the observable. To be a critical realist is to extend these views into social science." (Fleetwood 2002) CR'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 … These structures are not spontaneously apparent in the observable pattern of events; they can only be identified through the practical and theoretical work of the social sciences." (Bhaskar 1989) Bhaskar (1978) outlines what he calls three domains: the *real*, the *actual*, and the *empirical* (Table 1). The *real* domain consists of underlying structures and mechanisms, and relations; events and behavior; and experiences. The generative mechanisms residing in the real domain exist independently of, but capable of producing, patterns of events. Relations generate behaviors in the social world. The domain of the *actual* consists of these events and behaviors. Hence, the actual domain is the domain in which observed events or observed patterns of events occur. The domain of the *empirical* consists of what we experience; hence, it is the domain of experienced events.

Bhaskar argues that "…real structures exist independently of and are often out of phase with the actual patterns of events. Indeed it is only because of the latter we need to perform experiments and only because of the former that we can make sense of our performances of them. Similarly it can be shown to be a condition of the intelligibility of perception that events occur independently of experiences. And experiences are often (epistemically speaking) 'out of phase' with events — e.g. when they are misidentified. It is partly because of this possibility that the scientist needs a scientific education or training. Thus I [Bhaskar] will argue that what I call the domains of the real, the actual and the empirical are distinct." (Bhaskar 1978). Critical realism also argues that the real world is ontologically stratified and differentiated. The real world consists of a plurality of structures and generative mechanisms that generate the events that occur and do not occur. From an epistemological stance, concerning the nature of knowledge claim, the realist approach is non-positivistic which means that values and facts are intertwined and hard to disentangle.

	Domain of Real	Domain of Actual	Domain of Empirical
Mechanisms	X		
Events	X	X	
Experiences	X	X	X

Table 1: Ontological assumptions of the critical realist view of science (Bhaskar 1978). Xs indicate the domain of reality in which mechanisms, events, and experiences, respectively reside, as well as the domains involved for such a residence to be possible.

Critical realism is a well-developed philosophy of science, but on the methodological level it is less well-developed. Unfortunately, from an IS design science research perspective, most of the writings on CR research methods have been in the behavioral sciences, i.e., for theory development and theory "testing", and not for the development of theory for design and action (design science research).

Critical realism has influenced a number of social science fields, e.g., economics, management and organization studies (Ackroyd & Fleetwood 2000; Fleetwood & Ackroyd 2004). With few exceptions, CR is almost invisible in the IS field. Mingers (2004), Mutch (2002), Carlsson (2004), Dobson (2001), and Longshore Smith (2005) argue for the use of CR in IS research and discuss how this can overcome problems associated with positivism, constructivism and theories like ST and ANT. This paper uses CR as an underpinning philosophy for IS design science research.

DEVELOPING INFORMATION SYSTEMS DESIGN KNOWLEDGE

This section presents and discusses an IS design science research framework based on CR. It starts with discussing what types of IS design knowledge should be produced and for whom. This is followed by a presentation of how IS design knowledge can be produced. Guiding our framework development is Pettigrew's (1997) idea of the primary double hurdle: IS design science research should meet the criteria of scholarly quality and practical (professional) relevance.

For whom should IS design research produce knowledge?

March (2006) argues that "Relevance, rigor and results are the trifecta of academic research" and that they are defined by the constituency that comprises and supports the IS discipline. This IS constituency includes "IS academic researchers, organizations that develop and deploy information technologies (IT), organizations that produce and implement such technologies, IS managers within such organizations and, more and more commonly, general and upper level managers within such organizations." (March 2006) Our view is that the primary constituent community for the output of IS design science research is IS professionals and managers responsible for IS/IT-supported and enabled processes and activities. This means primarily professionals who plan, manage and govern, design, build, implement, operate, maintain and evaluate different types of IS/IT initiative and IS/IT. The design knowledge this community demand include: 1) knowledge for developing IT/IS-enabled solutions (including improving previous implemented solutions) that primarily address organizational problems, and 2) knowledge for how to implement and integrate the solutions into the organizational context. The developed IS design knowledge is to be applied by individuals who have received formal education, or a similar training, for example, in the IS field. An IS-professional can be defined as a member of a fairly well-defined group who solves real-world IS-problems with the help of skills, creativity and (scientific) IS-design knowledge. (For simplicity we call the problems IS-problems although it is more correct to say that someone has defined a problem where one, for one reason or another, has decided to try to solve the problem with an IS-initiative). Another important community is IS education, which means that the knowledge should be useful in different types of IS study programs and IS courses.

Although, the primary constituent community works primarily in organizations driven by profit (utility) "maximization", it should be stressed that CR also has a critical and emancipatory component (Bhaskar 2002).

The two schools discussed above have a clear management perspective and certainly not an emancipatory or critical stance. The emancipatory and critical issue is important, but here we note it and leave the issue for further exploration and development—see, Longshore Smith (2005) for how the use of CR in IS research can work critically and emancipatory.

What types of IS design knowledge can IS design research produce?

IS design science research should develop practical design knowledge to solve classes of IS-problems. This means the development of abstract knowledge that can be used in designing and implementing IS initiatives. The knowledge is abstract in the sense that it is not a recipe for designing and implementing a specific IS-initiative for a specific organization. A user, for example, an IS professional, of the abstract design knowledge has to ”transform” the knowledge to fit the specific problem situation and context. The knowledge takes the form of field-tested and grounded technological rules—will be discussed below.

Following Pelz (1978), we can distinguish between conceptual and instrumental use of science and research output. The former involves using knowledge for general enlightenment on the subject in question and the latter involves acting on research results in specific and direct ways. Both types are relevant for the IS field, but design science research addresses primarily the development of design knowledge for instrumental use.

Using van Aken's (2004) classification we can distinguish three different types of designs an IS professional makes when designing and implementing an IS-initiative: 1) an *object-design*, which is the design of the IS intervention (initiative), 2) a *realization-design*, which is the plan for the implementation of the IS intervention (initiative), and 3) a *process-design*, which is the professional's own plan for the problem solving cycle and includes the methods and techniques to be used in object- and realization-design. IS design science research should produce knowledge that can be used by the professionals in the three types of designs. The three designs include process and product design and also realization-design. Given, that the framework has a broader perspective—IS intervention in a socio-technical system—than the schools discussed above, it can be argued, based on the IS implementation and IS failure literature, that realization-design knowledge is critical and should be developed.

Design knowledge as field-tested and grounded technological rules

Following Bunge (1967), we can say that design science research aims at developing "stable" norms of successful human behavior, i.e. rules. Van Aken (based on Bunge) defines a technological rule as ”…an instruction to perform a finite number of acts in a given order and with a given aim."; and a technological rule is ”… *a chunk of general knowledge, linking an intervention or artefact with a desired outcome or performance in a certain field of application*." (van Aken 2004) A technological rule is general, which for IS design knowledge means that a rule is a general prescription for a class of IS-problems. Since a technological rule should be used by practitioner it should be applicable and actionable. Generally, the form of the technological rules is like: if you want to achieve A (outcome) in situation B (problem) and context C, then something like action/intervention D can help because E (reason). "Something like action/intervention D" means that the rules are to be used as design exemplars.

A field-tested and grounded technological rule has been tested empirically and is grounded in science. The latter means primarily grounding in results and theories from the behavioral sciences. How to develop and test technological rules will be discussed in the next section. Field-tested and grounded technological rules will in most cases be in the form of heuristics—as exemplified in the above section. This is consistent with critical realism's view on causality (Bhaskar, 1978, 1998; Groff 2004; Hedström 2005) and means that the indeterminate nature of a heuristic technological rule makes it impossible to prove its effects conclusively, but it can be tested in context, which in turn can lead to sufficient supporting evidence (Hedström & Swedberg 1998; Groff 2004; Hedström 2005; Tsoukas 2005).

Developing IS design knowledge

Van Aken (2004) suggests that management design science research has much in common with CR-based evaluation research of social programs. We agree with van Aken and suggest that evaluation research based on CR can work as a major contributor to IS design science research. Related work has started on developing a critical realistic IS evaluation perspective (Carlsson 2003) which builds on critical realism and realistic evaluation (Pawson & Tilley 1997; Kazi 2003; Mark et al. 2000). In line with CR-based evaluation research, the intention of our IS design science research framework is to produce ever more detailed answers to the question of *why* and *how* an IS initiative works, *for whom*, and *in what circumstances*. Using the framework means that a researcher attends to how and why an IS initiative has the potential to cause the (desired) change. In this perspective, an IS design science (ISDS) researcher works as an experimental scientist, but not according to the logics of the traditional experimental evaluation research. Bhaskar states: "The experimental scientist must perform two essential functions in an experiment. First, he must trigger the mechanism under study to ensure that it is active; and secondly, he must prevent any interference with the operation of the mechanism. These activities could be designated as ‘experimental production’ and ‘experimental control’.” (Bhaskar 1998)

ISDS researchers do not perceive that IS initiatives “work”. It is the actions and non-actions of different stakeholders and participants that make them work, and the causal potential of an IS initiative takes the form of providing the reasons and resources to enable different stakeholders and participants to “make” changes. This means that an ISDS researcher seeks to understand why and how an IS initiative, for example, the implementation of an Enterprise System, works through understanding the action mechanisms. It also means that an ISDS researcher seeks to understand for whom and in what circumstances (contexts) an IS initiative works through the study of contextual conditioning.

ISDS researchers orient their thinking to context, mechanism, outcome pattern configurations (CMOCs). This leads to the development of transferable and cumulative lessons from ISDS research. A CMOC is a proposition stating what it is about an IS-initiative which works for whom in what circumstances. A refined CMOC is the finding of an evaluation of an IS initiative. Outcome patterns are examined from a “theory-testing” perspective. This means that an ISDS researcher tries to understand what the outcomes of an IS initiative are and how the outcomes are produced. Hence, the researcher does not just inspect outcomes in order to see if an IS-initiative works, but analyzes the outcomes to discover if the conjectured mechanism/context theories are confirmed.

In terms of generalization, an ISDS researcher through a process of CMOC abstraction creates “middle-range” theories. These theories provide analytical frameworks for interpreting differences and similarities between classes and sub-classes of IS-initiatives. Given that the goal is to develop design theories and knowledge—to construct and test CMOCs explanations—for practitioners ISDS researchers need to engage in a learning relationship with IS practitioners.

ISDS research based on the above can be carried out through an IS design science research cycle (Figure 1).

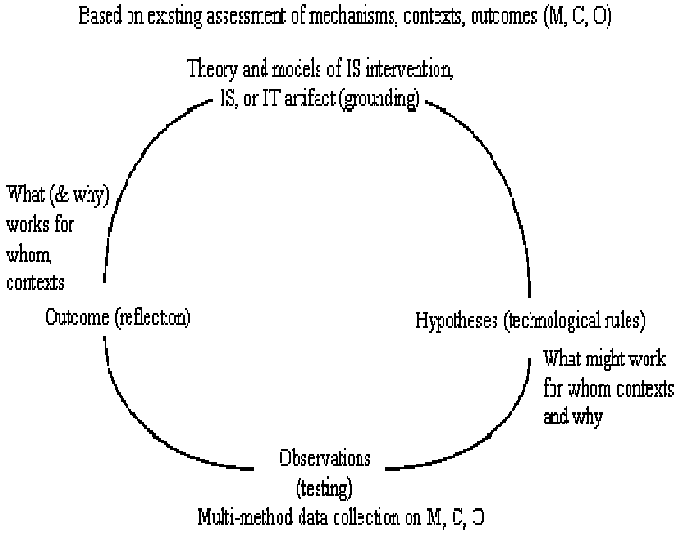

Figure 1: The Information Systems design science research cycle—based on Pawson and Tilley (1997), Kazi (2003), and Pawson (2006).

The starting point is theory and problems, need, or issues. The research is driven by “practical” problems/issues and/or business needs. Problems or symptoms can be identified by practitioners or by researchers. For example, an organization can have the problem that “ERP-use is not leading to desired outcomes”. The problems can also be identified through quantitative studies carried out by a researcher. For example, the researcher can analyze a data base containing IS use data and look for unwanted patterns. The theory includes propositions on how the mechanisms introduced by an IS-invention into a pre-existing context can generate (desired) outcomes. This entails theoretical analysis of mechanisms, contexts, and expected outcomes. This is the first step in developing technological rules and means that one tries to generate technological rules using our current knowledge, that is, grounding in theory. In general, the IS-researchers have been far from good in systematic reviews of research results. Pawson (2006) shows, from a CR-perspective, how to do systematic reviews and make sense of a heterogeneous body of literature. Using Pawson approach it should be possible to “test” and refine IS interventions. For example, it is possible to move away from the many one-off studies in the IS-field and instead learn from fields like medicine and policy studies on how to develop evidence-based IS design knowledge. Such a systematic review can be part of the starting point.

The second step consists of generating more specific "hypotheses". Typically the following questions would be addressed in the hypotheses: 1) what changes or outcomes will be brought about by an IS-intervention (initiative), 2) what contexts impinge on this, and 3) what mechanisms (social, cultural, and others) would enable these changes, and which one may disable the intervention. In this step the technological rules are refined.

The third step is the empirical test. It is done through intervention and guided by theory and technological rules. The step includes also the selection of appropriate data collection methods. ISDS research employs no standard research design formula. The base strategy is to develop a clear theory of IS initiative mechanisms, contexts and outcomes. Given the base strategy, an ISDS researcher has to design appropriate empirical methods, measures, and comparisons. CR-based ISDS research is supportive of: 1) the use of both quantitative and qualitative evaluation methods, 2) the use of extensive and intensive research design, and 3) the use of fixed and flexible research design. In this step it might be possible to generate support of the IS-intervention's ability to "change" reality.

Based on the result from the third step, we may return to the IS-intervention to make it more specific as an intervention of practice. Next, but not finally, we return to theory. The theory may be developed, the hypotheses and the technological rules refined, the data collection methods enhanced, etc. To develop the technological rules means that the cycle will be repeated. As said above most of the technological rules will be heuristic. Through multiple case-studies one can accumulate supporting evidence which can continue until 'theoretical saturation' has been obtained. The researcher can be more or less active in the implementation (use) of the technological rules. The researcher can be very active and work like an action researcher, but can also be quite passive and work like an observer.

The suggested framework can be summarized as (adapted from van Aken, 2004):

Characteristic	IS design science research framework
Dominant paradigm	Design science
Focus	Problem solution focused
Perspective	Researcher as experimenter (intervener)
Logic	Intervention-outcome
Typical research question	Alternative IS interventions for classes of problems
Typical research product	Tested and grounded technological rules (design knowledge)
Nature of research product	Primarily heuristics
Justification	Saturated evidence
Type of resulting theory	Practical and abstract IS design theory and knowledge

CONCLUSION, DISCUSSION AND FURTHER RESEARCH

We have pointed out some limitations and weaknesses in the two major IS design science research schools and suggested that critical realism (CR) could be a fruitful philosophical underpinning for IS design science research and for an IS design science research framework. We presented a framework based in critical realism. The framework has a broader view on what types of knowledge IS design science research should produce. This broader view is a direct consequence of that we do not just focus the IT artifact, but instead focus a socio-technical system containing people, organization, IS, and IT.

We think the proposed framework has several advantages. First, it is based on an explicit philosophy of science, critical realism (CR). As noted, most IS design science research is based on positivism. CR overcomes some of the problems noted in positivism and constructivism.

Second, the framework has a broader view on what type of knowledge should be produced. It views IS as socio-technical systems. Given, some of the current technological and business changes we think this broader view is appropriate. For example, many organizations are not longer viewing ERP-projects as technical projects, but as major re-organization projects; and the increased use of COTS and different forms of sourcing requires new relevant knowledge to be developed. A recent study suggests that business related IS-issues are becoming more and more critical (Zweig et al. 2006).

Further theoretical and empirical work is required to develop and test the use of CR in IS design science research. Currently, we are using the framework in a major study focusing on the implementation of customer relationship management where CRM-systems are critical means. Our suggestions make no claims to be the final word in the debate on IS design science research, but research based on the framework can lead to a stream of research that can develop high scholarly quality and practical (professional) IS design science knowledge.

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