Pertti Järvinen

Two different goals in design science research, one from science another from practice

UNIVERSITY OF TAMPERE

REPORTS IN INFORMATION SCIENCES 52/2017

TAMPERE 2017

UNIVERSITY OF TAMPERE
REPORTS IN INFORMATION SCIENCES 52/2017
FEBRUARY 2017

Pertti Järvinen

Two different goals in design science research, one from science another from practice

ISBN 978-952-03-0401-0 (pdf)

ISSN-L 1799-8158
ISSN 1799-8158

Two different goals in design science research, one from science another from practice

Pertti Järvinen
University of Tampere

Abstract

We normally think that in design science research (DSR), in a new research approach, there is only one research goal: Does it work? Is it improvement? In the classical articles there have been seen such goals as utility, efficiency and effectiveness. Recently in the literature there have been trials for theory development but we here want to emphasize goals. We know that the goal of behavioral-science research is truth. But the goal of DSR is utility (or something like). The latter is often reported but we propose that the former (truth knowledge) can also be reported in connection with DSR. Many interesting parties in the design project can have their own goal but our literature is lacking a many-faceted description of design goals and therefore we try give a more light to many design goals.

Introduction

March and Smith (1995) and Hevner et al. (2004) emphasize that utility is important in DSR. The former also mention that truth is associated with natural and the latter with behavioral sciences. Both papers much discuss about utility and other measures from the user side of view in development phase only but their attention is only partially focused on truth. Kuechler and Vaishnavi (2012) have prepared a framework of theory development in design science research for IS (information science) researchers. Hence it is important to relate our research domain to their framework and show that they neglect goals or goals are only implicitly considered. We can state that in this paper two types of goals (utility and truth), and many interesting parties with differing purposes behind are analyzed.

We then in this paper want to pay more attention to truth, i.e., to a traditional research work in connection with DSR. Another aspect that seems to be lacking is: Whose utility is in question? Almost all the articles speak about one party only, directly or indirectly about management. To this end our other topic is many interesting parties.

A framework of Kuechler and Vaishnavi (2012) and implicit goals in DSR

We shall shortly present Kuechler and Vaishnavi's framework and relate our domain (goals) to it. Already Hevner et al. (2004, p. 88) found that "effective design requires knowledge of both the application domain (e.g., requirements and constraints) and the solution domain (e.g., technical and organizational)". It is reasonable to speak about the problem and solution, i.e., initial and desired domains. In the initial domain Kuechler and Vaishnavi (2012) assume that researchers have found (meta)requirements and constraints (kernel theories in Walls et al. (1992)) staying in a problem domain and have later developed an artifact that stays in a solution domain.

Kuechler and Vaishnavi (2012) used Walls et al. (1992, 2004) and their kernel theories to describe design of artifact. They first introduced their three key acronyms and things that we shall follow:
1. Design science research in information systems (DSRIS), it is a research methodology in the IS discipline in which new knowledge is produced by the construction and evaluation of “artifacts”, broadly defined as software, composite systems of software, users and use processes, and IS-related organizational methodologies and interventions. Key elements distinguishing DSRIS from

behavioral IS research are: the ability to explore new, as yet un-theorized areas, constructivist rather than statistical methods and, as suggested in the paper of Kuechler and Vaishnavi (2012), the ability to build as well as test theory;
2. Information systems design theory (ISDT), it is as initially introduced by Walls et al. (1992, 2004), is a set of primarily prescriptive statements describing how a class of artifacts should behave (meta-requirements) and how they can be constructed. Some years ago, suggestions have been put forth for expanding the scope of design theory to include more "justificatory knowledge", or information indicating why the artifact behaves as it does (Gregor & Jones, 2007):
3. Design relevant explanatory / predictive theory (DREPT), it is a type of theory suggested by Kuechler and Vaishnavi (2012) that augments the "how" information content of the traditional ISDT statement with explanatory information explaining why the artifact has the effects it does. The explanatory information may borrow theoretical information from the natural, social, or design sciences. DREPT is similar to but more formally stated than the "justificatory knowledge" proposed as an addition to ISDT.

Kuechler and Vaishnavi (2012, p. 398) write that "as the logical entry to our framework for theory development in DSRIS, we explicitly represent ISDT and DREPT as knowledge representations, each capturing a different sort of design-related knowledge; this is illustrated in Figure 1."

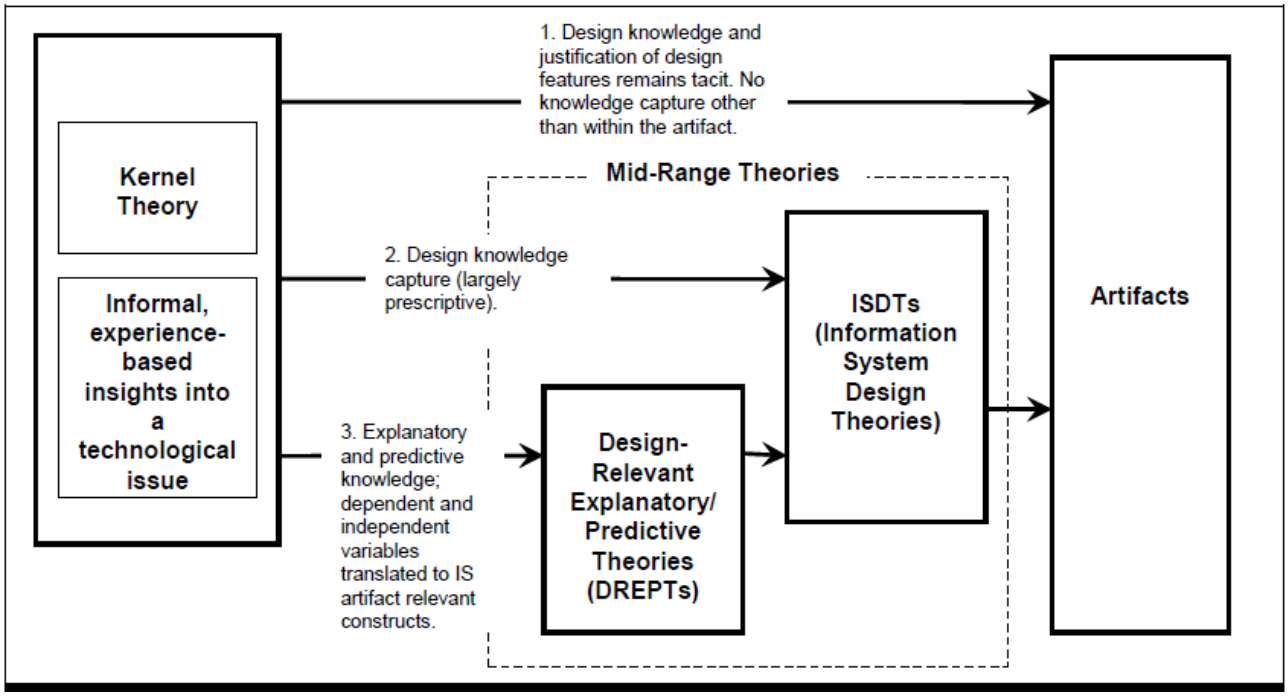

Figure 1. ISDTs and Design-Relevant Explanatory/Predictive Theories (DREPT) as Mid-Range Knowledge Representations in Design Science Research (Vaishnavi and Kuechler 2012, p. 399)

"The arrows of Figure 1 represent logical progression – from highly abstract notions through their progressive concretization to the physical artifacts themselves. As we will discuss in a later section, the actual process of knowledge translation and development in DSRIS may also proceed inductively (from right to left in Figure 1) as well as deductively/abductively (from left to right in Figure 1) or along both paths." (Kuechler and Vaishnavi 2012, p. 398)

At the left hand side expression "informal experience-based insights into a technological issue" is also called 'tacit' theory otherwise in (Kuechler and Vaishnavi 2012) and helps researcher/user to build a new artifact when no theory exists in a development work. It corresponds to arrow 1 in Figure 1.

Walls et al. (1992) based their work at differentiation between design product and design process in kernel theory. Figure 1 mainly describes a theoretical relationship between kernel theory (Walls et al. 1992) and an artifact. Hence ISDT largely relates to a development process and DREPT to action in a final state.

For our aims of this paper both the definitions of ISDT and DREPT and Figure 1 do not contain goals explicitly but implicitly. Hence to our mind, it is important to consider and analyze goals explicitly in the following sections and show that also the truth goals are valuable to be presented. In addition, we shall pay attention to many interesting parties not to one party only.

On the two goals, utility and truth

Hevner et al. (2004, p. 79) say it clearly: "The goal of behavioral-science research is truth. The goal of design-science research is utility". They also inform us that those relationships proved to be true can be a basis of a development work performed in DSR. The reason is that a system is moved from the problematic state (initial state) to the final state by utilizing that relationship. It can also be used at the final state of the system to improve it.

We have named the two important states, the initial and final ones, too. It is sometimes considered needless to describe the initial state of a system precisely. On the contrary, the final state of a system is almost always described in detail. Hence, we often have the relationship between the initial state to the final one. We then have one or two states determined and we can compare them with reality: Are they true or not? In this way we can test a certain theory containing variables and their relationships, i.e., we can perform a normal research in connection with DSR. This particular normal study is almost always done but very seldom reported, although researchers have a chance to test theory in their DSR.

We have earlier shown how DSR is similar to action research (Jarvinen 2007a) and Davison et al. (2012) found that in action research there are two theories, the focal and instrumental ones. According to them “focal theory also plays a critical role in the action plans, since any plan must be underpinned by theoretical cause-and-effect relationships" (Davison et al. 2012, p. 770). This means a support for our claim that a particular relationship may explain an intended increase (or decrease) in utility and/or particular relationship can also be used in a development of a certain artifact.

To our mind, a system can be seen consisting of three types of resources, physical (mostly IT), social and informational resources. The physical and data resources often behave regularly and then the relationship is assumed to be functional or numerically equally to 1. According to Hevner et al. (2004, p. 79) "behavioral science theories seek to predict or explain phenomena that occur with respect to the artifact’s use (intention to use), perceived usefulness, and impact on individuals and organizations (net benefits) depending on system, service, and information quality (DeLone and McLean 1992, 2003)". It seems that it is also assumed that the social resource behaves regularly. But it seldom happens, and hence we need a more careful research concerning behavior of social resource. Antti Arvela supported this view in his comment on this text in a manuscript phase by paying attention to learning in general and with a detailed study. Namely, learning will change relationships found in earlier studies.

Concerning newness of research output it can be one of the three ones: Novel, supporting and contrasting. When human beings are replaced by technology, especially by IT artifacts, the utility is sometimes multiple and then relationships related to IT technology are bypassed without reporting these and novel results are forgotten. - When a certain relationship between two variables in kernel theory will receive support, i.e., this relationship will help a new artifact to achieve its purposes as expected, this support will not always be reported. - In contrasting case, the relationship in question does not help a new system to achieve its purposes. Then in fact our development trial is not successful and this trial is forgotten. The result, however, can sometimes be reported but as warning.

On multiple interesting parties

We know differentiation between work and capital in working life, and there are two interested parties behind, the working class and owners. The pair often has differing goals and this difference can be reflected on the goals in information systems. Chua et al. (2005, p. 265) see six types of stakeholders (customer, internal organization, supplier, investor, regulator, indirect) and it is more many-sided classification of interested parties that can have even more differing goals. A customer and a supplier form such a pair that their goals are interesting but often differing. We have demonstrated that in design problems there are more than one interesting party, and the two or more parties can have differing goals. It is a good reason to require utility measurement from more than one party's point of view.

We actually proposed "the *goal function* under which all kinds of different interests can be collected" (Jarvinen 2007b, p. 5). This means that the goals from different parties are collected and weighted by their value and a result of the weighted sum is achieved. This assumes that competing parties can negotiate and weigh their interest. It seems to us that it is possible to achieve a wanted common goal in multi-party environment. - To our mind, a term 'goal function' is a bit more neutral and more universal than utility and it is better than such restricted and weakly defined goals as efficiency, effectiveness, quality and others. Negotiation as such means that more than one party accepted a system developed, and hence this system probably is more long-lasting than the system prepared from one party's point of view.

Discussion

We have demonstrated that in almost every DSR effort there is some goal function and in addition some other results (new, supporting or contrasting) from traditional research, how does a new system function? We recommend negotiation about the desired goal between important parties, presentation of the goal function used and its value, and the results concerning the theory used. The latter can tested in reality possibly both during the artifact development process and in the state achieved, at least in one of them.

The results from traditional research belong to section called 'implications to science', the goal function and its value to section 'implications to practice' (cf. Schwarz and Stensaker (2014, 2016).

We know that our implicit assumption has been mainly concerned the traditional a → b (a and b variable) instead of an interactive pair, a → b and a ← b (cf. Giddens 1984, Rohde et al. 2016). This example more describes a problematic and difficult situation with social resource that we cannot know enough this far. It is also a good proposal for further research.

References

Chua C.E.H., H.M. Khoo, D.W. Straub and S. Kadiyala (2005), The evolution of e-Commerce research: A stakeholder perspective, Journal of Electronic Commerce Research 6, No 4, 262-281.

Davison R. M., M. G. Martinsons and C. X. J. Ou (2012), The roles of theory in Canonical Action Research, MIS Quarterly 36, No 3, 763-786.

DeLone W.H. and E.R. McLean (1992), Information systems success: The quest for the dependent variable, Information Systems Research 3, No 1, 60-95.

DeLone W.H. and E.R. McLean (2003), The DeLone and McLean model of information systems success: A ten-year update, Journal of Management Information Systems 19, No 4, 9-30.

Giddens, A. (1984). The Constitution of Society. Outline of the theory of structuration, Cambridge: Polity Press.

Gregor S. and D. Jones (2007), The anatomy of a design theory, Journal of the Association for Information Systems 8, No 2, 312-335.

Hevner A.R., S.T. March, J. Park and S. Ram (2004), Design science in information systems research, MIS Quarterly 28, No 1, 75-105.

Järvinen P. (2007a), Action research is similar to design science, Quality & Quantity Vol 41, No 1, 37-54.

Jarvinen, P. (2007b), On Reviewing of Results in Design Research (2007). ECIS 2007 Proceedings. Paper 72. http://aisel.aisnet.org/ecis2007/72/

Kuechler, W. and V. Vaishnavi (2012), A Framework for Theory Development in Design Science Research: Multiple Perspectives, Journal of the Association for Information Systems 13, No 6, pp. 395-423.

March S.T. and G.F. Smith (1995), Design and natural science research on information technology, Decision Support Systems 15, No 4, 251-266.

Rohde A., P. Brödner, G. Stevens, M. Betz and V. Wulf (2016), Grounded Design – a praxeological IS research perspective, Journal of Information Technology 31, No. , 1-17. DOI: 10.1057/jit.2016.5

Schwarz G. and I. Stensaker (2014), Time to Take Off the Theoretical Straightjacket and (Re-)Introduce Phenomenon-Driven, The Journal of Applied Behavioral Science 50, No 4, 478-501. DOI: 10.1177/0021886314549919

Schwarz G. and I. Stensaker (2016), Showcasing phenomenon-driven research on organizational change, Journal of Change Management 16, No 4, 245-264. http://dx.doi.org/10.1080/14697017.2016.1230931

Walls J.G., G.R. Widmeyer and O.A. El Sawy (1992), Building an information system design theory for vigilant EIS, Information Systems Research 1, No 1, 36-59.

Walls J.G., G.R. Widmeyer and O.A. El Sawy (2004), Assessing information system design theory in perspective: How useful was our 1992 initial rendition?, Journal of Information Technology Theory and Application (JITTA) 6, No 2, 43-58.