

# Design Research in e-Government

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## Abstract

This paper investigates if design research in e-government should be conducted in some special way compared with standard models for design research. It reviews literature in e-government and design research in order to generate an answer to this research question. The result is affirmative that the policy character of e-government should have consequences for the way that e-government design research is conducted. A tentative e-government design research model, consisting of different activities is formulated. This model consists of the activities: theorizing, policy analysis, workpractice analysis, co-design and co-evaluation of IT artefact and workpractice. One important result from this paper is the formulation of the concept of the policy-ingrained artefact as an important empirical result from e-government design research.

## Introduction

Research in e-government can take many different shapes. There can be broad comparative studies. There exist evaluations of e-government systems. There exist also evaluations of e-government programs and also analyses of regulations and policies. Criticism has been asserted that e-government research is not so theoretically oriented, but anyhow there exist several conceptual frameworks based on empirical studies. Much of this e-government research seems to be oriented towards “what is”, but there exist also research on “what ought to be”.

“What is” means an emphasis on traditional empirical research with descriptions and explanations (Gregor, 2006). This is not the only way to conduct research within information systems (IS). During the last two decades there has been an articulation and application of a design-oriented research paradigm for IS research under labels such as development research, design research, design science and design science research (e.g. Nunamaker et al, 1991; March & Smith, 1995; Hevner et al, 2004; Hevner & Chatterjee, 2010). Even if this way of researching has had a long tradition in IS, it seems to be a shift in acceptance and legitimacy after the articulation of the design research (DR) foundations (ibid). Design research means research through design. It is not only research about design. DR means scholarly work through the conduct of design. New knowledge is created through designing new artefacts. This includes the generation of prescriptive knowledge of how to design something (Gregor, 2006). Such knowledge is sometimes given the label design theory (Gregor & Jones, 2007). As indicated above there is confusion and controversy how to label this kind of design oriented research. I will use the term design research throughout this paper.

The purpose of this paper is to investigate design research in e-government. The pending research questions are: Should e-government design research be conducted in some special way or can it apply to general models of IS design research? In what ways differs e-government DR to general IS DR? If there exist any decisive differences, what implications will that have on the way DR should be conducted in e-government?

A tentative model on e-government design research will be presented as a response to these questions. It is based on studies on design research frameworks and long experiences from design and evaluation oriented research in e-government. The empirical basis is however not explicitly brought into this paper. Such empirical illustration will be done in future research.

The main idea of this paper is thus to investigate e-government design research being a sub-class of the general class design research. The attempt to clarify features of this sub-class will lead to specification of

features that are distinctive to the super-class and other sub-classes but in some cases there might also be an articulation of features that are valid for the super-class and possibly also for other sub-classes. A clarification of features that are valid for the super-class design research should be seen as a by-product of this inquiry and it is beyond the scope of this paper to make a sharp differentiation between distinctive and general features of e-government design research. The message of the paper is that there are some distinct features that call for a special treatment of design research in e-government.

## **Prior research overview**

### ***Design research***

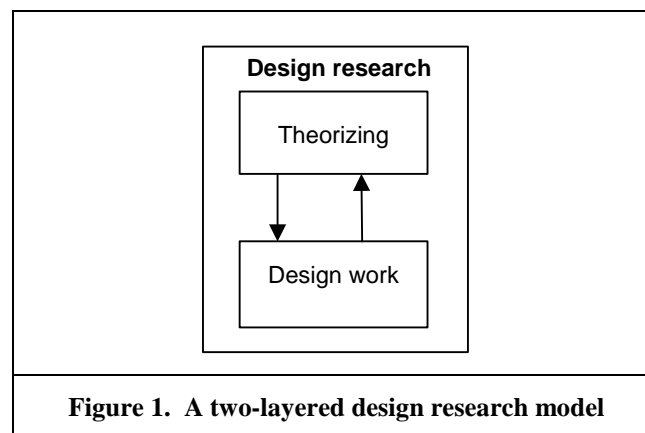
Design research has been contrasted to behavioural research (Hevner et al, 2004). Behavioural research is explanation-oriented research aiming for describing “what is”. It can include predictions, but these are purely based on explanations about what is. Predictions is about “what will be” based on what we know about the circumstances at state. Behavioural research has its roots in traditional natural and social science. Design research has its roots in engineering research and is based on the dichotomy of the science of the natural vs. the science of the artificial (Simon, 1996). Design research is concerned with the creation of something possible. It investigates and creates new artefacts. This is done in order to explore and demonstrate the possibilities of new artefacts. There are many scholars that rightly position DR within a science of the artificial, but it can also be positioned in a pragmatist view of science (Goldkuhl, 2012a) following Dewey (1931): “An empiricism which is content with repeating facts already past has no place for possibility and liberty”. Design research is concerned with creating a new possible world and doing this in scholarly way.

In the seminal work of Hevner et al (2004) a framework for design research in IS has been presented including seven guidelines. DR is meant to contribute to both practical needs and to the knowledge base of science. The design of a new artefact through DR is done as a response to business needs in the practice environment and is also based on application of knowledge from the scientific knowledge base. The core of design research is described as a build – evaluate cycle. An artefact is designed through a series of build and evaluate iterations.

Peppers et al (2008) have presented a process model for design research. This model is based on a synthesis of several other process proposals. The suggested DR process consists of six subsequent activities: 1) problem identification and motivation, 2) define the objectives for a solution, 3) design and development, 4) demonstration, 5) evaluation and 6) communication. This six-stage process model expands the build – evaluate cycle of Hevner et al (2004). There are two initial activities that are placed before any build/design occurs; the identification of problems in practice and the definition of objectives for the solution. Demonstration means to test the proposed artefact in some setting and this activity is inserted between build/develop and evaluate. A last activity consisting of communication to researchers and other audiences has also been added.

Another DR process model has been suggested by Sein et al (2011). They have developed an approach that integrates design research and action research under the label of action design research (ADR). Their purpose has been to broaden DR from narrow techno-centric views. They present a four stage model: 1) problem formulation, 2) building, intervention and evaluation, 3) reflection and learning and 4) formalization of learning. This process model can thus be seen as a synthesis of DR models and action research models (as e.g. Susman & Evered, 1978; Davison et al, 2004). One key principle in ADR is the “theory-ingrained artefact”. Sein et al (2011) emphasise that DR should be theory-informed. This means that the built artefact should incorporate certain characteristics based on theories that have informed the design process. One important influence from action research is the emphasis on reflection and learning. Sein et al (2011) stress the importance of generalized outcomes in terms of design principles. This is done in some contrast to the work of Hevner et al (2004) who are a bit reluctant to include theoretical results from DR. In the view of Hevner et al, the main outcome from design research is the IT artefact; “the result of design-science research in IS is, by definition, a purposeful IT artifact created to address an important organizational problem” (ibid p 82).

Design research has, in the writings of e.g. Hevner et al (2004) and Peffers et al (2008), an emphasis on the concrete design process. There are several scholars who have argued for a more explicit theorizing activity within DR; e.g. Venable (2006), Winter (2008), Goldkuhl & Lind (2010) and Lee et al (2011). It is not only that the design process should be theory-informed. The DR process should include theorizing in order to create theoretical outcomes. In the ADR process model (Sein et al, 2011), the activities of reflection and learning indicate the importance of abstraction and theorizing. In the model of Peffers et al (2008) it is only “communication” that indicate this kind of abstraction. In contrast to these more linear models, two-layered frameworks have been presented by Winter (2008), Goldkuhl & Lind (2010) and Lee et al (2011) distinguishing the concrete design process from theorizing activities. With inspiration from these scholars such a two layered design research model is depicted in figure 1.



In the ADR approach to design research, Sein et al (2011) argue for a broader perspective on the IT artefact based on the ensemble view from Orlikowski & Iacono (2001). In such a view, the IT artefact is seen as 1) embedded in a social context and 2) as a carrier of its social context (ibid; Goldkuhl, 2012b). The artefact is seen as a carrier of institutional elements from its social context.

### ***E-government research and design***

A simple conceptual model of e-government research is proposed by Goldkuhl (2012c); the PDE model. It consists of three constructs *policy*, *design* and *effects*. The message is that designed IT artefacts of e-government should not be studied in isolation. They should be studied in relation to intended and unintended effects and also in relation to governing policies. A salient feature of e-government is the role of the political governance (Peristeras et al, 2002; Grönlund & Horan, 2004; Fountain, 2005). What is done in public administration is based on legal regulations and policy declarations. There is no IT artefact in e-government that does not have any relation to policy of some kind. Egov artefacts apply and build on legal acts and other regulations (e.g. Allouache & Khadraoui, 2011; Knackstedt et al, 2012) which make them to “legal machines”. The use of IT in public administration can be seen to be a process of policy and value implementation (Fountain, 2001; Flak et al, 2009; Virili & Sorrentino, 2009; Persson & Goldkuhl, 2010; Rose & Persson, 2012; Hellang & Flak, 2012). The concept of policy is in this paper used in an encompassing way including laws, regulations, policy declarations, workpractice goals and other value-statements.

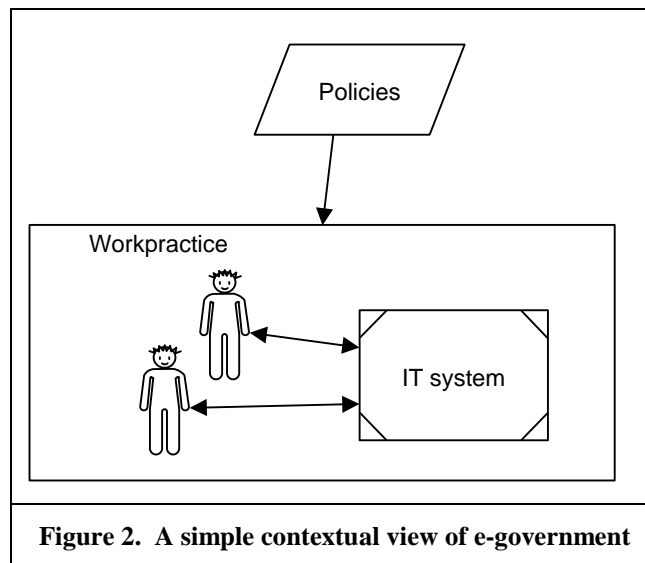
The basic stance here is that there are fundamental differences between public administration and private/commercial organisations. This is based on the fact that public agencies (including their IT systems) are parts of societal regulation (Lenk, 2002; Goldkuhl, 2011). This emphasis of differences should not be interpreted as a denial of the existence of certain similarities between public agencies and private/commercial firms concerning organisational structure and information systems. There exist many studies that have investigated such differences and similarities and also hybrid forms between them (e.g. Perry & Rainey, 1988; Bretschneider, 1990; Rainey & Boozemann, 2000).

Lenk (2007) asserts a demand in relation to egov research that “two black boxes have to be opened: the nature of ‘ICT’, and the nature of the work of public administration at its operative level where it ‘executes’

public policies and where the menial tasks of public governance are carried out” (ibid p 207f). The workpractices of public administration needs to be understood in order to clarify the roles of IT artefacts. This is the case both in pre-assessment (i.e. before any IT design) and in post-assessment (i.e. evaluating the use of egov IT systems).

The interest for the workpractice context can be seen in many different studies using different labels. One such area of interest is the orientation towards business process management. The introduction of IT will enable improvement of governmental business processes, which has been studied by many scholars, e.g. Andersen (2002), Scholl (2003), Becker et al (2006), Hughes et al (2006), Chourabi (2009) and Niehaves & Plattfaut (2010). This interest for workpractice is also demonstrated in institutionally oriented research, e.g. Fountain (2001), Hjort-Madsen (2007), Alghatam & Cornford (2012) and Cordella & Contini (2012).

The object to inquire and intervene in e-government design research can be said to consist of the IT artefact and its surrounding workpractice context including human actors and the different policies that govern the workpractice and its IT artefacts. A simple model of this is found in figure 2.



Fedorowicz & Dias (2010) have investigated a ten year sample of egov papers (from the Annual Digital Government conference) concerning the use of a design research approach. They conclude that only a minor portion of papers apply a DR approach and those who do so rarely position their research explicitly in such terms. “Few digital government studies self-identify as belonging to this research paradigm; others present their technological artifact as a case study without grounding in a common methodology or design science framework or theory” (ibid p 6).

Fedorowicz & Dias (2010) have also identified a narrow techno-centric approach among these papers (“few of these papers indicated the contribution of their work beyond the technical benefits of the artefact”; ibid p 6) and they point out the need for egov DR to take a broader social view: “artifact designers are confined by financial, organizational, and political realities that extend beyond technical requirements ... researchers are wise to consider social realities when designing and examining situated artifacts” (ibid p 6). What can be concluded from their study is that 1) there seems to be need for a specific egov DR approach and 2) the need for such approach to take a broader social view.

There exist several research endeavours in e-government that have explicitly applied a design research approach, e.g. Karacapilidis et al (2005), Olbrich & Simon (2008), Liu et al (2007) and Zwicker et al (2010). In all of these studies policy has been taken into account. However, there have not been any discussions in these studies about the challenges in a DR case to apply policy or other aspects specific to the e-government context. Based on an e-government case study, Papas et al (2012) have compared action research and design research, but the contextual features of e-government seem to have been left out from this analysis.

The conclusions to be drawn here are that there has not yet been articulated a design research approach to e-government. There exist egov DR studies; some of them do not identify them as such and those who state that they apply an explicit DR approach have not conducted any specific adaptation of DR to the egov context.

## Towards a model for e-government design research

Based on the review of prior research above several demands can be raised concerning design research in e-government. The starting point for this analysis is the standard models of design research as Hevner et al (2004) and Peffers et al (2008). The iterative construct of build/design and evaluate (March & Smith, 1995; Hevner et al, 2004) seems to be a pivotal element in DR. Hevner et al (2004) claim the importance that the design is based on practical needs. In Peffers et al (2008) this is operationalised in the first step of the DR process: “problem identification”. The analysis of practical needs and problems must however be elaborated further than what is made in Hevner et al (2004) and Peffers et al (2008). The emphasis of viewing the IT artefact as contextually embedded as in the ADR approach (Sein et al, 2011) calls for a broader scope. As mentioned above, Lenk (2007) calls for looking into the operational work of public administration. This follows also the business process orientation in egov as well as its focus on institutional aspects (literature mentioned in the review of egov research above). The design approach should be a co-design approach, i.e. co-designing the workpractice and its IT artefact in an integrated way. As a consequence of this, evaluation should be seen in similar way as a co-evaluation of the workpractice and the IT artefact.

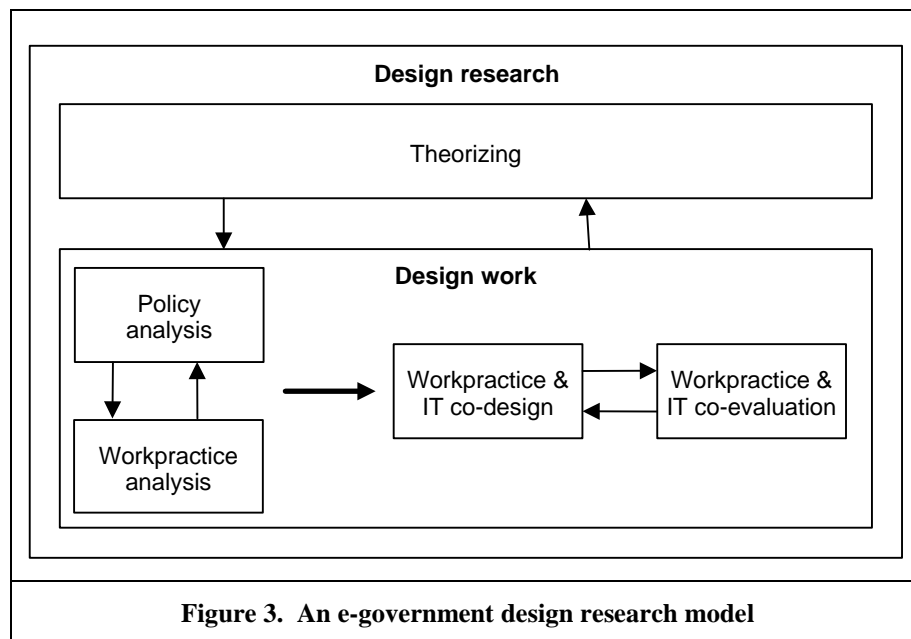
Peffers et al (2008) specify the second step in their DR process model to be “define the objectives for a solution”. It seems very important in an egov context that this involves a broad investigation of the policy and value background. The analysis must move beyond the immediate problems in the workpractice and thus derived objectives. An analysis should be performed with an explicit direction to the different policies that is relevant for the workpractice and the IT artefact to be designed; i.e. an analysis of legal acts, regulations, policy declarations and other values. If an egov design is to be a policy implementation process, then an in-depth policy analysis is needed.

As described above (in the review of design research), DR cannot be limited to a design process. The need for abstraction including the use and generation of theory needs to be acknowledged. Design research must include theorizing otherwise it cannot be distinguished from plain design. Theories should be generated but also used to inform the design process. Sein et al (2011) have introduced the notion the “theory-ingrained artefact” to be a characteristic result from the design research process. In egov DR, the IT artefact should not only be theory-ingrained. We could also talk about the *policy-ingrained artefact*. This can be said to follow the ideas within the ensemble view of the IT artefact as a contextual carrier (Orlikowski & Iacono, 2001; Sein et al, 2011; Goldkuhl, 2012b). The IT artefact in e-government should be a *policy carrier*. There are important distinctions in this respect between a typical egov system and an IT system in a commercial enterprise. The egov system carries policy from outside the specific organisation and sometimes also policy from within the organisation. Elements from laws and other governing values influencing the specific public agency will transit to the design of the egov system making it a policy carrier. A typical IT system in a business firm will of course be influenced by the firm’s (internal) goals and policies, but seldom by public policy and law.

Several additions and modifications have above been argued for compared with the standard DR models of Hevner et al (2004) and Peffers et al (2008). E-government design research should include:

- Theorizing as an explicit part of DR in order to 1) furnish relevant theoretical governance for design and to 2) generate a theoretical outcome from DR
- Policy analysis to investigate the policy/value basis for design in order to be able to create a policy-ingrained artefact
- Design to be considered as co-design of IT and workpractice
- Evaluation to be considered as co-evaluation of IT and workpractice

Based on these extensions, a tentative design research e-government model can now be formulated. Such a model is depicted in figure 3. It is based on the model in figure 1 above.



## Conclusions

The research question “shall design research in e-government be conducted in some special way” has been affirmed. The public policy character of e-government is distinct and should imply consequences for the way egov DR is conducted. Policy analysis should be an important part of such design research. The critical analysis of standard models of design research (e.g. Hevner et al, 2004; Peffers, et al 2008) has also implied certain improvements that are relevant for egov DR. It is important to conduct the design activity in a co-design manner, i.e. a co-design of the workpractice and the IT artefact. The same goes for evaluation, i.e. a co-evaluation of the workpractice and the IT artefact. One important contribution of this paper is the formulation of the concept of the policy-ingrained artefact as an explicit empirical result of e-government design research.

This paper has not contained any explicit empirical illustration. It is however based on extensive experiences from practical design research in e-government. Future research needs to bring in such research examples as sources of illustration and validation.

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