

DDF Project Description

Designing Methodology: Effect-Driven IT-Development

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1 Summary:

Effects-Driven IT Development is a relatively new approach to managing the process of IT systems development and implementation. Research began in 2004 and is currently on-going in connection with a number of current IT development and implementation projects in the healthcare sector in Denmark. The project described in this proposal aims using an action research approach to build on existing research results to develop a coherent, synthesized compilation of tools, descriptions, guidelines and *best practices* for and about the use and application of the approach in IT development and other knowledge domains. The project will also investigate the principles underlying the process of transforming a theoretical approach to a practical approach capable of being employed by non-researchers and how promote and ensure the approach's dissemination and diffusion.

1.1 Research Goals

Effects-Driven IT Development has been the subject of on-going empirical and exploratory research since 2004 and its principles have been developed and tested in multiple practical situations and the results of these research efforts have been published in numerous peer-reviewed articles and presented at appropriate conference venues. *Effects-Driven IT development* is called a *management instrument* rather than a *method*, firstly, because it has a narrower scope or role than would be expected of a method and secondly because it can be used to manage and support activities and processes that are controlled by the content of other more domain-specific methods or approaches.

“While effects specification, realization, and assessment individually resemble other research, their integration into an instrument for managing IT projects is unique to effects-driven IT development”. (Hertzum & Simonsen, 2011B)

Effects-Driven IT Development. Specifying, Realizing and Assessing Effects Usage (Hertzum & Simonsen, 2011B) can be considered authoritative for an understanding of the *Effect-Driven IT development* approach. The intention has been to create or develop a general approach that is not domain specific, and which could therefore be applied in a wide range of contexts where it would be beneficial to be able to apply a well-tested, well-documented approach to guiding the development of IT-enabled and non-IT-enabled processes.

The project proposes to determine to what extent of the approach is used and whether the context is commercial, experimental or academic and analyze and describe whether and in which way the approach is similar or differs from other related or similar approach/areas of research such as *Participatory Design* (Bødker, Kensing, & Simonsen, 2004) (Simonsen & Hertzum, Iterative Participatory Design, 2010), *User-Centered Design and Organizational Change*. Using models of organizational adoption of technological innovations such as Rogers' (2003) and Gallivan's (2001) as a point of departure, we propose develop and testing a method for *disseminating* the Effects-Driven IT Development approach in the context of real use of healthcare IT-systems in hospitals in the Zealand Healthcare Region, and on that basis proceed to scale up in anticipation of and in conjunction with the imminent implementation of the EPIC Healthcare Platform.

1.2 Project Description

The empirical context of the project will be the ongoing development and use of IT systems at the Nykøbing Falster Hospital, primarily the distributed *electronic whiteboard* system, which is a functioning system, and universal IT healthcare platform EPIC. The *Electronic Whiteboard* system was recently implemented in all of the departments of all of the Region's hospitals while EPIC will be implemented starting in late 2015. Roskilde University (RUC) has from its very inception been involved in a continuous stream of research projects related to the electronic whiteboard system, in which researchers from RUC collaborated with the healthcare region and the hospital at Nykøbing Falster in developing and implementing the system. The majority of the research conducted with regard to the *Effects-Driven IT Development* approach was undertaken in the context of these projects there is already a rich source of theoretical and empirical information on the subject to build on. The proposed project will be associated with 2 projects revolving around clinical process analysis and development and IT systems implementation at Nykøbing Falster Hospital: (a) *Transferring Patients and Competency Development in Effect-Driven Optimization* and (b) *Bottlenecks and Load Barometers (Patient Trajectories)*. Both projects have a research focus on developing an approach enabling clinicians to use the *Effect-Driven IT Development* in modifying clinical procedures and processes independently of academic researchers.

1.3 Project Participants and their network

Professor Jesper Simonsen (RUC) will be the project's senior researcher while Jens Vejrup Lassen (RUC) will be participating as a Ph.D.-candidate. The following researchers will be collaborating (unpaid) with the project, as their research has a similar focus: Professor Morten Hertzum (University of Copenhagen, Information Science), who has interests in *Participatory Design* and *Effects-Driven IT Development*, associate professor John Damm Scheuer (RUC, Business Studies)

who has interests in *Organizational Change* and *Effects-Driven IT Development* and professor Helene Karasti (University of Oulu, Finland) who has interests in *Ethnographic Approaches, Infrastructuring and Participatory Design*.

1.4 Research Topic:

The research activities will have a theoretical aspect with diffusion methodology and the methodology of the approach itself, while it will also entail practical activities the purpose of which is to provide solutions to practical problems encountered by clinicians in using the IT systems to perform healthcare related tasks: The research question may be formulated as follows:

”How can we design an IT-System Development method so it disseminates rapidly and effectively?”

2 Effects-Driven IT Development: Theory and current Status

Heeks (2006) claimed when in writing about failures in healthcare information systems that 20 - 25 % of delivered systems were total failures, while 33 – 60 % were partial failures. Heeks conceptualized total failure as a situation where a system was either never implemented or abandoned immediately after implementation. Partial failure was less cut and dried, as Heeks sees that as a situation where goals are only partially attained, or there are undesirable effects. Sometimes the notion of partial failure is relatively straightforward, but is often the product of a subjective judgment. Michael Krigsman (2008) has estimated a 68 % rate of failure for IT projects. Other, more recent, examples of IT project failures reported on were:

- The UK NHS patient records system at a cost of £10 bills. (The Guardian, 2013)
- A UK Ministry of Defense recruitment site for a cost of £1, 3 bills. (The Guardian, 2014)
- An UK Offenders database for a cost of £690 mills. (BBC , 2009)
- A BBC digital project for a cost £100 mill. (BBC, 2013)
- The failed Danish Police Records system for a cost of kr. 567 mills. (Breinstrup, 2014).

IT systems development and implementation remain evidently a truly challenging type of activity and a successful outcome is in no way assured. Ways or approaches of improving chances of success continue therefore to be in demand. The success criteria for the development and/or implementation of an IT-systems project may be objective as well as subject. For example, the customer (procurer) of an IT-development or implementation project may consider it as a partially or wholly failed project even when the project has been delivered in total compliance with the terms of the contract entered between the IT vendor and the customer (Hertzum & Simonsen, 2004). This would occur when the IT vendor delivers the IT-system in accordance with contractual terms, thus

fulfilling the objective criteria for a successful outcome, but where result of the project does not lead to an IT-system providing the benefits that the customer perceives as being desirable in that context as the agreed specifications of the system were unable to articulate the real needs underlying the need for the system. An approach called *Evidence-based Development* was proposed as an instrument for guiding the development of an IT system and its vendor-customer relationship project in such a way as to better ensure a satisfactory outcome for the partner (Hertzum & Simonsen, 2004). Briefly, the hypothesis was that by substituting *system functionality* with *measurable effects* predetermined by agreement between the vendor and customer, common goals and desired outcomes could be efficiently managed. The underlying preferences are:

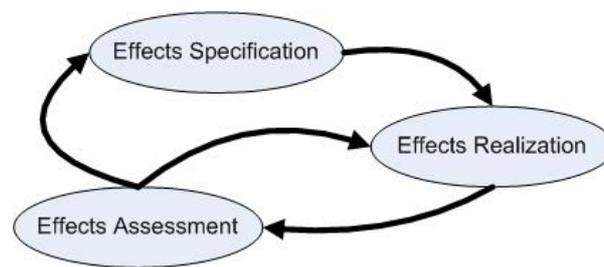
- Effects over products and processes
- Measurement over expectations and estimates
- Evidence-based contracts over functionality contracts.

The approach was tested using exploratory and empirical research methods in two on-going studies in healthcare domains, and the conclusion was that the evidence-based development approach linked contractual fulfilment to evidence of effects causing contractor to focus on measure effects for users, but required further refinement and testing. In continuance of this study, further research was conducted from 2005 to 2012 within the framework of multiple healthcare IT projects in collaboration with several partners, mainly Healthcare Region Zealand, but also some municipalities and IT vendors. The list of projects for that period is:

- Clinical Process 2005-2006 (Møller-Jensen, Simonsen, & Iversen, 2006)
- Clinical Monitoring 2005-2006 (Simonsen & Hertzum, A Regional PD Strategy for EPR Systems: Evidence-Based IT Development, 2006).
- Healthcare Centre Workspace 2007-2008 (Barlach & Simonsen, 2011)
- Electronic Medication Record 2007 – 2008 (Granlien, Hertzum, & Gudmundsen, 2008), (Granlien M. , 2010), (Granlien & Hertzum, 2009), (Hertzum & Granlien, 2007)
- Maternity Ward 2010-2011 (Simonsen, Hertzum, & Barlach, 2011)
- Clinical Overview 2009-2012, (Hertzum M. , 2011), (Hertzum & Simonsen, 2013)

The general principles developed and tested in these projects were a further development of the original principles of evidence-based IT development. The term *Effects-Driven IT Development* began to displace the original term in 2009, and is now the exclusively used term for this approach. Why this name change came about is not explained anywhere, but could serve to eliminate the distraction of implying presuppositions about methods of an epistemological nature. (For a critical analysis of *Evidence-Based Practice*, see Hjørland (2011)). A high-level model of the Effects-Driven IT Development approach is seen in the figure immediately below, where a cycle starts with

the *effects specification*. The effects are incorporated into a *pilot implementation*, which is then tried out in limited, but real use (Hertzum, Bansler, Havn, & Simonsen, 2012). This stage of use is followed by a formative evaluation of whether and to which extent effects were achieved as anticipated by the effect specification. At this time unanticipated or new effects could be discovered as part of the process, enabling a fresh cycle to be initiated, in which the *effects specification* is amended and extended based on input from the evaluation stage (Hertzum & Simonsen, 2011B). The hypothesis being that the end result of letting systems development and implementation be guided by this approach would result in fewer discarded or dissatisfactory system implementations.



(Hertzum & Simonsen, 2011B)

The specification of effects is guided by an *effects specification model*, which is structured in five levels, with the lowest level being the most concrete or specific and the highest level being the most abstract or general. (See diagram below left) Each level is related to its adjacent levels so that a given level may be both a specification of an effect as well as a realization of an effect. Each level is a realization of the effect specified at the next higher level. The lowest level effect specification is realized by very specific program code, configuration files or process descriptions.

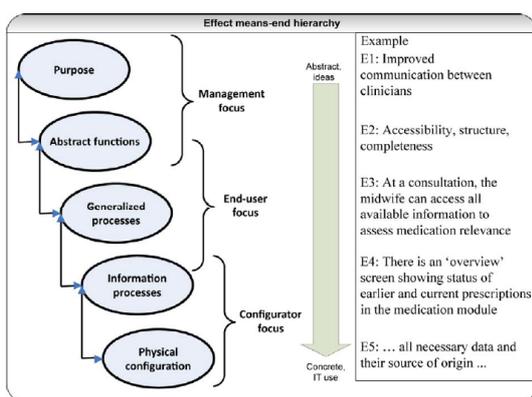


Figure 2. Effects specification in five levels, ranging from strategic, through tactical, to operational effects.

(Simonsen, Hertzum, & Barlach, 2011)

Effects hierarchy	National Indicator Project (NIP)	Standard treatment plans
Environment (political demands, national standards, legislation etc.)	National indicators improve the quality of treatment	Coherent patient trajectories, knowledge sharing
Strategy (response to environment, abstract function)	High quality in NIP recordings	Standard treatment plans
Process (recurrent, familiar, input-output relationships)	Well-documented patient trajectories	Well-documented patient trajectories
Work domain (information-processing task with need for IT support)	Situations in which NIP data are produced	Acute admission of stroke patients
IT system (functions, information, categories, standards, user interface etc.)	Functionality capturing NIP data at their source	Template with checklist for junior physicians

Figure 8. Examples of hierarchically specified effects.

(Hertzum & Simonsen, 2011A)

There is empirical evidence in relation to IT Healthcare projects that management will tend to focus on the top two levels while clinicians tend to focus on the lower three. In the above model, it appears that the lowest level is configuring a configurable IT healthcare system, while in the

diagram below; the lowest level consists of configuring a *template* for a checklist for younger physicians. The example shown above right shows how effects-specifications need not be realized in the creation or configuring of IT artifacts but can also be realized as written instruments.

3 Methodology and Publication

3.1 Methodology

The project's research methods have their point of departure in *Action Research* methods (Avison, Lau, Myers, & Nielsen, 1999), (MISQ 2004), (Van de Ven, 2007), (Mathiassen & Nielsen, 2008) as well *Ethnographic* approaches (Orlikowski & Baroudi, 1991), (Blomberg, 1993), (Button & Sharrock, 2009), (Myers, 2013), (Blomberg & Karasti, 2014) while relating to the methods and approaches of the *Participatory Design* field (Bødker, Kensing, & Simonsen, 2004), (Simonsen & Hertzum, 2010), (Bratteteig, Bødker, Dittrich, Mogensen, & Simonsen, 2012), (Karasti, 2014). Researchers will be guiding and assisting clinicians in assimilating and deploying the principles of *Effect-Driven IT Development* in developing clinical processes while the project will be developing and testing tools, guidelines and approaches to using *Effects- Driven IT-Development* in real use (Kensing, 2003). As the interventions progress the diffusion and dissemination of the method will be tested and evaluated (Gallivan, 2001), (Rogers, 2003). Analysis of empirical data collected in the course of interventions will be conducted using qualitative approaches (Punch, 2005), (Myers, 2013), (Simonsen & Friberg, 2014).

3.2 Plan and Schedule of Activities

- July - Dec. 2015: Literature review, project establishment, writing for publication
- Jan. - June 2016: First iteration of inventions, identifying clinicians' needs, challenges and context for real use, developing tools and designing interventions, writing for publication and publishing.
- July - Dec. 2016: Second iteration of interventions, testing and reviewing feedback, writing for publication and publishing.
- Jan - June 2017: Third iteration using revised materials, identifying novel discoveries, develop a strategy for scaling up the approach for the ongoing implementation of the EPIC healthcare IT platform, writing for publication and publishing.
- July - Dec. 2017: Analysis of novel discoveries and using those results identifying clinicians' requirements for use, writing for publication and publishing.
- Jan. - June 2018: publishing articles, writing and publishing dissertation.

3.3 Publication of Results

Publication of work will be a continuous process, with publications being submitted to recognized publishing outlets relevant to the particular focus of the research. Healthcare focus would indicate submitting work to the *International Journal of Medical Informatics*, *Health Informatics Journal*, *International Health Informatics Symposium* or *Scandinavian Conference on Health Informatics (SHI)*, *Medical Informatics Europe (MIE)* amongst others while a focus on user centered design would indicate, *Computer Supported Collaboration Work (CSCW)* and the *Participatory Design Conference (PDC)*. More general topics would indicate outlets such as the *Scandinavian Journal of Information Systems* and *Information Systems Research Conference in Scandinavia (IRIS)*.

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