# Effects-driven IT development in an organisational context

## PhD plan for Maren Fich Granlien

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Funded by Region Zealand (50%) and Roskilde University (50%)
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This phD plan defines the outlines for my future PhD work the next two and a half year.
I started this phd august the 15th 2006 and plan to finish the 14th of august 2009.
The Phd are enroled in the Design and Management of Information Technology (DMIT) programme. The scholarship advertisement was on what at that times was referred to as Evidence-Based Development, which now is called Effects-driven IT development.
*"The aim of this project is to investigate how the effects of the use of a system could play a prominent role in the contractual definition of IT projects and how contract fulfillment could be determined on the basis of evidence of these effects. The hypothesis is that by substituting system functionality with measurable, agreed-upon effects of using the system, the contract will provide more appropriate means for managing the customer-vendor relationship and working systematically toward meeting customer goals."[From the scholarship advertisement]*

The focus of the project has subsequently shifted, at least temporarily, away from the contractual aspect and toward using effects-driven measurements for formative evaluations *during* the process of systems development. This new focus will be elaborated in the following, primarily in the first two main sections.

This Phd plan will show how I will contribute to the overall aim of the project referred to above.
First I will shortly introduce the aspects of system development which lead to the idea of Effects-driven IT development, which I will briefly introduce together with my use or understanding of the term. This combined with the area of change management, leads to the focus of this PhD project and the research question.

# 1 Introduction

**System development**

Currently, in the field of system development the requirement specifications, in terms of system functionality, play an important role in both the development process as a design document but also in regulating the relationship between the vendor and the customer as a contract. [Sommerville 2004]

This approach has shown certain shortcomings. There have been examples of systems fulfilling the contract with the specified functionalities but with out being accepted by the uses as a system that supports there work and fulfil their needs. Besides, the creation of the requirement specifications has shown not to be an easy task, and a lot of IS(information systems) failures regardless of type, can be traced back to problems with the requirement specification.(Hoffmann and Lehner, Requirements engineering as a success factor in software projects cited in (Pekkola et al. 2006)

Another problem is that the requirement specifications are the fundament for two very different documents, it serves as a contract document, thus as an agreement between the customer and the vendor specifying what to be done for which price at within a certain time. As a legally binding document it should therefore be as fixed as possible. At the same time the requirement specifications also serves as a design document for the developer to know what to develop and how, and as a design document it should be both dynamic and flexible in order to support the development process. Furthermore flexibility is also required because of changing user's needs through the development process.

The difficulties with the construction of the requirement specification has been a topic in the IS literature and there has been developed several methods trying to improve the process dealing with specifying functionality and requirement, such as scenario based requirement specification, use case based, prototyping (Gomaa and Scott 1981; ; Jeffrey et al. 1999; ; Annie et al. 2001) and participatory design, which provides a big part of that discussion. (Khaled El et al. 1996), Bødker et al. 2004]

**Effects-driven IT development**

Another attempt to overcome some of the challenges and shortcomings with requirements specifications is effects-driven IT development. The notion of Evidence-Based Development is "invented" by Hertzum and Simonsen (Hertzum and Simonsen 2004). The term or the notion is still in the making. This is also illustrated by the changing of the name. We are a small research group on Roskilde University, Department of Communication, Business and Information Technologies consisting of Jesper Simonsen, Morten Hertzum, two PhD fellows, Anders Barlach and I who are working with effects-driven IT development. Talking about evidence, effects and measurable results etc. in IT development is not something unique. (Dyba et al. 2005; ; TeknologiskInstitut 2007) Our focus is on using effects as a tool in the development and implementation process – a formative evaluation.(Hamilton and Chervany 1981)

The idea behind effects-driven IT development is to shift the focus from functionality and requirement specification toward a focus on usage effects – effects obtained through

adoption and actual use of the system. [Hertzum & Simonsen 2006 forthcoming] The ultimate goal is to remove the traditional contract model and exchange it with a commercial contract model based on measurements of agreed upon effects of using the system (Simonsen and Hertzum 2005)
The thoughts behind effects driven IT development are developed primarily in the healthcare sector and mainly for developing electronic patients records (EPR) but the idea of effects-driven IT development is generally applicable to all kind of IT projects in all kinds of domains.
Effects-driven IT development aims at establishing strategic partnerships between vendor and customer in order to develop state of the art EPR solutions with proven value and a measured effect on the clinical work the system supports. Measurable effects are defined in relation to clinical work practices within documentation and decision making. (From the scholarship advertisement)

They way I see effects-driven IT development is as a focus or a tool you can apply to the development process or the implementation process, maybe to all IT enabled change processes. The focus or tool can be applied on two levels. The first level it can be used as a tool for evaluating the process - are we going in the right direction. As illustrated in figure one as thermometers taking the temperature. But on this level it can be used to define and evaluate the desired results by specifying some wanted effects and the measure if they a reached.

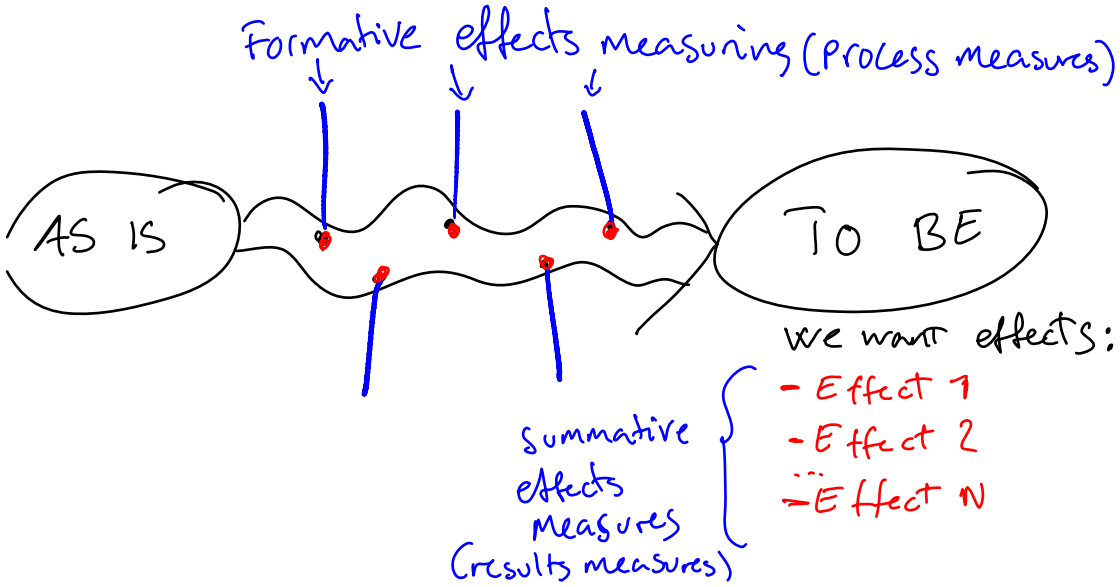


**Figure 1: First level of effects**

The other level where I see effects as a focus or a tool is to involve the users and focus on the outcome in order to reach the desired effects. See figure 2. Here the focus is not that much on the exact (formative) measures but on what talking about effects does to the users. Effects-driven IT development is closely connected to participatory design and is rooted in the tradition of participatory design. Perhaps therefore the intention of Effects-driven IT

development is to extend and strengthen the focus on user needs (Hertzum and Simonsen forthcoming). That is due to the processes and activities that shall lead to identifying the effects is very close to the process of specifying the users needs. By focusing on the effects specified and prioritised by the users Effects-driven IT development acknowledges and emphasises the practitioners' work and knowledge. Last Effects-driven IT development both gives developers and customers criteria against which the system should be evaluated. (Hertzum and Simonsen forthcoming).
The similarities between PD and Effects-driven IT development to some extent build on the premise that PD has a positive influence on IS and that we should strive for more participation in the different phases of IT and change projects. As I see it the notion of effects gives another focus in the user involvement. The focus on effects is seen as way for the users to express their needs in a language and with terms they understand. The notion of effects takes its point of departure in the vocabulary of the users and not in the language and degree of formalisation developers normally use in talking about functionality and design e.g. various UML diagrams such as domain models and design models. The process of requirement specification is very complex even when designing "simple systems. "This is because the often the users cannot properly articulate their needs"(Pekkola et al. 2006) Here I will question what properly means –does it mean in a language the developers can understand? Developers often speak a formalized language because the complexity of programming languages demands it. (Shaw, 2003) this can often be problematic when it comes to participatory design where the users are to be involved in the development process. Therefore the gap between the formalizations of the developers and the work practices of the users and the language they use to express it. (Agre 1995; 76) PD as a discipline has worked with ways to bridge that gap. (Bødker et al. 2000; ; Go and Carroll 2004) Go and Caroll use scenario-based system design as a common language that can be talked by the users and easily translated into more formalized models. The notion of effects can also be seen as a common language but it leaves a lot of work to the developers when it come to translating it into something more formalized. The thought is not for effects to stand alone but to be combined with other tools or methods within the frame of PD. E.g. prototyping. I have tried to illustrate the passion of effects figure 2. The example of formalizations is only examples that serves the purpose of illustration the position of effects and should not be considered to be exhaustive and the order can as well be discussed.

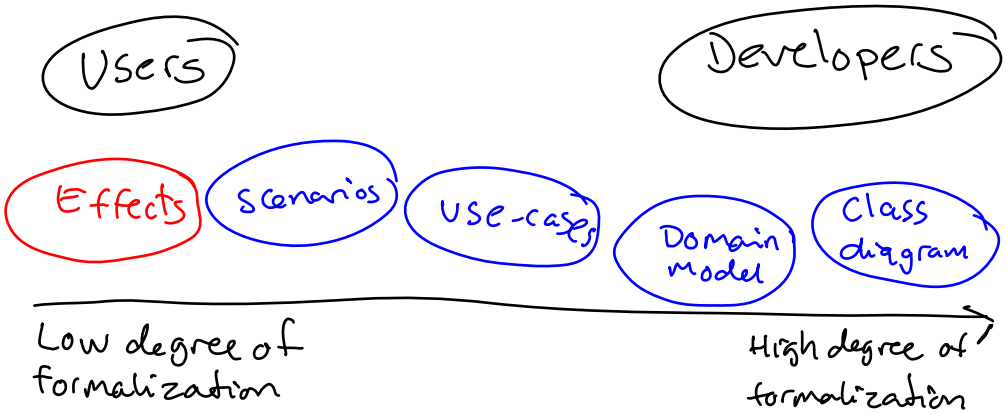


**Figure 2: using the notion of effects to involve the users**

**Effects-driven IT development and change management**

One aspect is the development of the system but another is the implementation and use of the system. To obtain usage effects it is not enough to develop a system that is capable of obtaining the effects and thereby accomplish the goals. It is also necessary for the system to be adopted and used in the right way. (Markus 2004) As the systems grow bigger and affects more heterogeneous groups the success of the system depends increasingly on the organisational aspects of the implementation process and use, than on the technical aspects of the system. (Lorenzi and Riley 2000) The system does play a role in obtaining the possible improvements, but it is merely one of several factors. As Markus(2004; 13) states:

> "[B]oth the solution and the process of arriving at solution are important. If the solution is a good one, but the process of designing and implementing the change is poor, people may reject the solution. If the design and implementation process is good but the solution is poor, the business results will be disappointing."

To draw benefits from the implementation process and obtain the wanted usage effects it is often necessary to combine the IT project with an organisational change project. (Markus 2004) points out that running an IT project parallel with an organisational change project is not enough to establish the desirable change and it will almost certainly not result in the anticipated improvements. The situation were IT is used to create organisational change to reach potentially usage effects is by Markus (2004) called 'Technochange'. To achieve the effects from technochange projects it is very important to manage them as such. Since "[…] using IT strategically to drive organizational performance improvements is fundamentally different from both IT projects and organizational change programs." (Markus 2004; 5) Markus therefore introduced the concept of technochange management.

According to the definition and description[1] of technochange projects by (Markus 2004) a lot of IT projects it the domain of healthcare would, as I see it, benefit from being treated and managed as Technochange projects.

In managing Technochange projects Markus talk about a technochange life cycle with a pre-project, a project and a two-parted post-project phase. What she calls Chartering, Project, Shakedown and Benefit capture. The four phases has different characteristics and involves different actors and activities and therefore needs to be handled differently. (Markus 2004; 10) The benefit capture phase can be seen as the phase where the summative measures are to be fulfilled and therefore it is important to achieve the effects by managing the project right through all the phases. The different characteristic will probably also affect the formative measures in the other phases. But mostly Markus' classification can support effects-driven IT development by being aware of the post project phases as the benefit capture or the effects capture phase. And it also states that there is a time perspective to be

[1] IT projects focus on the technological performance and reliability and the solution is new IT. Organizational change projects focus on improvements in the organizational culture and/or performance the solution is inventions focusing on people, structure and culture or human resources. Technochange focus on improvements in organizational performance and the solution is new It applications in conjunction with complementary organizational changes.

aware of when trying to conclude on the obtaining of effects.

| *Phase* | *Chartering* | *Project* | *Shakedown* | *Benefit capture* |
|---|---|---|---|---|
| Description | 'Ideas to Dollars' – phase during which the technochange idea is proposed, approved, and funded | 'Dollars to Solution' – phase during with the technochange solution is developed and technology is acquired or built; end when technochange starts up or 'goes live' | 'Solution to Usage' – phase during which the organization starts operating in a new way with technology and the organization troubleshoots problems associated with technology and new processes; the goal of the phase is 'normal operations' | 'Usage to Dollars' – phase during which the organization systematically derives benefits from the new way of working; may involve continuous improvements, 'upgrades', and 'conversions' of various kinds |

**Figure 3: Phases in the technochange life cycle. (Markus 2004; 11)**

There has been written numerous pages and developed extensive methods and approaches dealing with the project phase – developing information systems. (Beck 1999; ; Bødker et al. 2000) The pre and project phase is important to obtain usage effects but the post-projects phases might be even more important. And the high risk associated with IT and technochange projects, the users will not adopt and use the technology and the correlated work practices has to be dealt with much more comprehensively. One way to avoid that is to further investigate how to integrate the knowledge from organisational change management and implementation of IT. (Markus 2004).

# 2 Focus and research questions

## 2.1 Area of concern

As the name imply, effects and the ability to setup *measurable* effects of the *use* of the system plays a very important role in Effects-driven IT development. Therefore it is necessary to concern one with how to define and measure effects. But also how to develop an IT system capable of obtaining the defined effects is essential knowledge. Yet another important issue is how to *obtain* the usage effects. The effects are not necessarily, if at anytime, depended on the system alone. The attainment of effects is closely depended of the actual *use* of the system which again is influenced by lot of contextual factors. (Ash 1997; ; Demeester 1999; ; Berg 2001; ; Markus 2004; ; Aarts et al. 2004) Even if the system is capable of yielding the desired effects there can be factors affecting the implementation and use of the system preventing it from happening. (Markus 2004) These possible contextual factors are important to be aware of in the (techno)change process if the desired effects should be achieved. The believe that IT alone can create significant improvements and effects in organizational performance is what Markus call "magic bullet thinking" which is very unrealistic. (Markus 2004) Markus therefore states that IT and organizational change must be seen as an integrated entity: technochange. I have adopted this view into my work and therefore it does not make sense to try to associate the resulting changes with either IT or organizational factors since they are inseparable.
There are a lot of aspects to look into when dealing with development and implementation of IT systems, both in traditional approaches, but especially when developing a new approach like Effects-driven IT development. To further develop the approach it is important to gain knowledge about the factors influencing the obtaining of the desired effects.
The application domain of my studies is the healthcare sector which is a very complex domain consisting of a lot of organisational units doing different tasks relying on a huge amount of communication and coordination. There could be an almost infinite number of factors influencing the use and obtaining of effects. I will delimitate me from looking at political and economic factors but more focus on organizational factor including cultural, physical and social factors.
One of the very central factors could might be the users – the physicians, nurses, secretaries etc. They constitute the group of people who has largest amount of influence on the both the change process and the actual use of the system that should lead to the effects. Depending on the methods to measure the effects they will probably also play an important role in the measurement and evaluation of the effects.

My focus and contribution to the incipient idea; Effects-driven IT development is encapsulated in these 3 research question.

### Research question:

- What organizational, cultural and social factors besides the technology influencing the obtaining of effects and which of them seems most important and realistic to handle seen from the perspective of the users and customers?

- How do putting effects on the agenda help mediating the process of technochange in order to obtain effects?
- How can effects be defined and measured?

There are many ways in which we can create usage effects and there are great numbers of factors that influence the obtaining of usage effects. I will mainly concentrate on the actors involved, such as end-users, middle-level leaders and project managers. An important sub-issues to the research question could be the challenges with involving and maintaining the user involvement throughout the different phases with a particular focus on establishing use and usage effects in the post-project phase defined by (Markus 2004; 11).

One of the theses is that Effects-driven IT development can be used as a way to maintain the user participation through the project phase and thereby reach a wider adoption and more comprehensive use of the system and in the end obtain positive usages effects.

# 3 Research design and research approach

## 3.1 Frame and empiric setup

In this section I will present the frame and empiric setup for the PhD project. This also sets up the frame for gathering empirical data. Later I will elaborate on the research approach which serves as a methodological frame for gathering and analyzing the data. The analyzing of data is close connected to the research approach.

The PhD is co-financed by the Region of Zealand and the main part of the empirical work will be done within the region. I have a fruitful co-operation with the unit in the Quality and Development department in the region that works with IT in the health sector of the region – in the following referred to as the Clinical IT-unit.
The Clinical IT-unit has made a shift in focus from big waterfall projects to smaller more explorative step-by-step projects and is very interested in gathering knowledge about clinical usage effects but also the effects of an experimental strategy. (Simonsen 2006)
The second project pronounced to follow the new strategy is a project called KLIMO (a Danish abbreviation standing for "monitoring of clinical data") the project started out in June 2006 and I was involved in the project at the end of August 2006. (The first project was the clinical process project carried out in the fall 2006) I got the opportunity to follow it and participate in an action-research manner while gathering data.
The KLIMO project is a pilot implementation of a system for monitoring clinical work. The system is being tested on 3 different wards on 3 hospitals within the Region of Zealand. Before the pilot testing there were a series of configuration workshops where the physicians discussed a prototype, and what data to be registered and how to present it.
The actual pilot implementation is from the 20th of December to the 19th of January 2007. After pilot there is an evaluation workshop. If the wards find the system useful they can continue using it. And a continuing project focusing on expanding the use both geographically and maybe also to other areas of treatment will considered.
My role in this project is to lead parts of the workshops with a focus on effects. My mission is to initiate discussion about effects, to collect and present the remarks about effects and, in cooperation with the physicians, make a list of agreed-upon effects. I also have to do an evaluation of the project. Finally I have status as an observant and have access to observing and interviewing the participants.
During the first 6 month of my PhD study I have conducted an action research study of the KLIMO project along with an ethnographic inspired study on one of the wards. Subsequent empirical work in my PhD will be further case studies of a similar nature. Due to my collaboration with the Clinical IT-unit I also have the possibilities, in dialogue with the project managers, to influence future projects and planning of them.

## 3.2 Research design and approach

The overall research design builds upon a flexible design consisting of a collection of mainly qualitative methods. I might include quantitative methods related to the measure of usage effects. The flexible design entails that not all aspects of the research, such as theory,

research question, methods, sampling strategy and so on, is decided upon and fixed from the beginning. (Robson 2002)
The research approach and underlying assumptions builds upon interpretive case study(Klein and Myers 1999) and action research(Baskerville and Wood-Harper 1996; ; Checkland and Holwell 1998).

I have decided on interpretive studies because Interpretive methods in IS are "aimed at producing an understanding of the *context* of the information system, and the *process* whereby the information system influence and is influenced by the context" (Walsham 1993, 4-5) cited from (Klein and Myers 1999; 69) Further the assumptions of interpretive studies in IS are that we can only gain knowledge of reality though social constructions such as language, shared meanings, documents, tools and other artifacts. These assumptions are in accordance with my own believes and suits the explorative purpose of the study.

The action research approach is chosen because: "We cannot study a newly invented technique without intervening in some way to inject the new technique into the practitioner environment." quoted from Land in Wood-Harper 1989 cited from (Baskerville and Wood-Harper 1996; 240)] Whether Effects-driven IT development can be define as a *technique* can be discussed but it can be thought at as an idea that will have to be tested and refined. To do so we will have to try it out in praxis, this means that we as researchers will have to introduce it to praxis. According to Baskerville and wood-Harper (1996) action research is a very reasonable approach, especially in the field of IS research, if you want to combine research and praxis by both contributing to the practical concerns of the actual case and producing relevant research findings.

I will do different field studies along the project period. The first study will be an explorative field study with the purpose of generating knowledge about the domain and to identify problematic aspects and under-exposed issues that could be relevant for further investigations in following projects. The explorative study is also a mean to narrow the focus of the research question(s).

Both of the research approaches are applied to the first study. The explorative study can be thought as two parallel studies funded in the same empiric project.
The purpose of the action research part of the study is to try out ideas from Effects-driven IT development. To get experience with specifying effects that we could evaluate upon and measure, but the purpose was also to apply the ideas to see the result, in terms of how we could involve the users and how they reacted. Further we would like to investigated the development process and how the idea of the effect-driven it development can be integrated into the process. Here Anders Barlach a PhD fellow, whom I work together with and I will take actively part in the development process and facilitate the effect-driven approach in the project and gain knowledge about the approach and the implications it has on the process and the involved users.

The Interpretive part of the study is a more in depth case study or what sometimes is called a mini-ethnographic(Robson 2002; 187) study but the underlying philosophy is interpretive.

The purpose of the study is to explore the implications of the implementation of the system, the challenges related to the implementation and the users adoption and perception of it.

To sum up the overall research design is a flexible design, consisting mainly of qualitative methods with an underlying interpretive approach applied on an unspecified number of empirical (case)studies of IT development and implementation projects in the health sector of the Region of Zealand.

**The first study - KLIMO**

The KLIMO project is briefly described in the previous section, frame and empiric setup. KLIMO is the empiric setup for the first case study, an explorative study. My approach to this study is also divided into the two overall research approaches; interpretive study and action research. First I will use (Checkland and Holwell 1998) three basic elements to from the first study. Later I will elaborate on action research and how it is related to and conducted in this first study. I will also discuss the implications of the methodological choices of the study.

To frame and very briefly describe the first case study I will use (Checkland and Holwell 1998) three basic elements that are relevant to all research: Framework for ideas, Methodology and Area of interest/concern. (Checkland and Holwell 1998; 13-15)

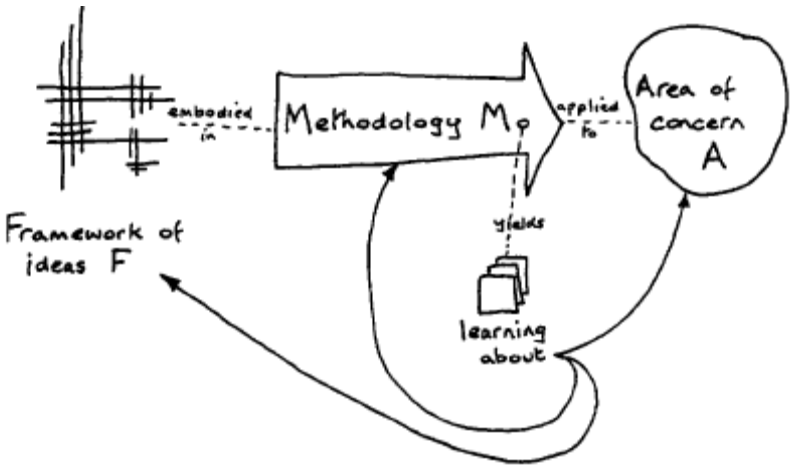


**Figure 4: Elements relevant to any piece of research (Checkland and Holwell 1998; 13)**

The framework is the incipient idea of Effects-driven IT development, combined with the assumption that the clinicians should not be turned into mini-developers talking about functions and attributes. Rather they should contribute with their extensive clinical knowledge. It would be better if the clinicians could talk their own language, the one of the clinical world and with that language formulate and prioritize desirable effects. We believe that by not expecting (or trying to educate) the clinicians to be "mini-developers", we empower the user and the choices and prioritizations in the process would be more genuine because the users know and understand what they choose when they speak of their own language. It should not be up to the user to guess what functionality would help them reach their needs and requests.

The methodology is action research, applying the thoughts of Effects-driven IT development to see if the assumptions holds true combined with interpretive case study.

The area of interest is IT implementations in the Danish healthcare sector. More specific the configuration workshops of a specific experimental development project in the Region of Zealand. The more concrete focus areas within this study is described in the section "Area of concern" page 7.

## 3.3 Analyzing data and data sources

The data analysis can be done in various ways depending on the data material and the purpose of the research.
Analyzing data was done in different ways both within the same study but the methods (e.g. categorizing, SWOT, diagnostic cards) differ from one case/project to another but with interpretive case study and action research as the central approaches.

The focus in the analysis has been on locating empirical observations/finding connected to the use and non-use of the system. And findings connected to the effects defined for the specific project. The focus and methods for analyzing data depends on the focus at the specific time in the project. And according to the plan the data analyzing process and focus will be described in a number of articles with different foci eliciting different aspects of the overall research focus.

The data sources:

- Field notes form observing system use and participation in workshops
- Transcripts of interview
- Video and audio recordings from Workshops and interviews
- Collectively produced notes from workshops
- Questionnaires
- Logbooks from the wards, where they have written down problems connected to the use of the system
- Notes from phone meetings with the local project managers

The empirical findings will bee discussed with the project managers from the EPR-unit, the project group[2] and within the research group[3]. Additionally a "light-version" of the findings will bee presented at evaluation workshops.

## 3.4 Possible theoretical approaches

This project is an empirically droved project. To answer the research question(s) it is necessary to gain knowledge about the use of IT systems, especially on user's perception of

[2] The project group consisting of project leaders from vendor and customer and mid-level managers and users from the different wards.
[3] The research group is called EDIT is focusing on effects-driven IT development. The group consists of two PhD fellows and two senior researchers and is a sub-group to the research groups user driven IT innovation at Roskilde University, department of Communication, Business and Information Technologies (CBIT).

the implementation and use of IT in a specific context. To get that knowledge it is compulsory to interview and observe them in the actual context of the specific project. The prominent role of the empiric work is both due to the research question but also because Effects-driven IT development is an incipient idea and there is not much theory with that exact focus.
Nevertheless are there related theories and frameworks that can serve as a starting point to aspects of the investigation. Following some relevant areas of theory/theoretical directions that I will look into - some more thorough than others.

**Theory about methodological approaches**
Due to the prominent role of the empiric work, an important discussion would be on the research approach. I believe that a lot of the discussion in the dissertation will be on the implications for my choice of Action Research and Interpretive Case studies as approaches to examine the research question. The research approach will be described in the 3rd section about gathering data.

**Participatory design**
Participatory design is an obvious choice, for more than one reason. Participatory design is dealing with the involvement of users in the design process, but also with analysing and designing work tasks and workplaces. Since Effects-driven IT development is developed out of a Participatory design tradition and emphasize the importance of user involvement as a mean to obtain usage effects it is a natural starting point.

**Change management (technomanagement) and implementation of IS**
Another interesting theoretical field is the one dealing with implementation and change management. This field is mainly concerned with controlling and predicting the change and implementation process. In this category we also find Lynne Markus' paper on technomanagement.

**Diffusion and adoption of technology**
Other relevant literature could be literature on diffusion and adoption of technology, dealing with how technology is introduced, implemented and taken into use. Here it is interesting to look at the factors that affects the users in taking the technology into use and thereby also obtaining the usage effects.

**Evaluation**
Literature dealing with evaluation of the impact of IT projects also seems very relevant. Most of the literature I have read states the importance of evaluation on the contextual factors and not only the specific aspect of the IT solution. The notion of evaluation is in some situations very close to the concept of Effects-driven IT development and the focus on obtaining and measuring of effects.

# 4 Writing: Composition of the PhD

The PhD thesis is planed to be a collection of articles with a longer introduction framing the project and elaborating the connection between the articles. The overall introduction will have a chapter with the overall research approach for the PhD. The more exact methodological approaches and choices concerning the specific projects and investigations should be described in the associated articles.
Some of the articles might build on a previous study of implementing IT support for shared care in the diabetes treatment. This study is concerned with factors affecting the use of two shared care systems in the Danish health care sector and would contribute to the first research question.

Rough time Schedule:

| Semester | 1. sem | 2. sem | 3. sem | 4. sem | 5. sem | 6. sem |
|---|---|---|---|---|---|---|
| Build up network and research contacts | | | | | | |
| Focussing research question and research design | | | | | | |
| Data collecting* | | | | | | |
| Data analysing | | | | | | |
| information brokering | | | | | | |
| Stay abroad | | | | | | |
| Phd courses | | | | | | |
| Theaching | | | | | | |
| Sammenfatning og afhandling | | | | | | |

*depends on the projects in the clinical IT-Unit

My information agency and teaching responsibilities will be a mixture of project supervision and course teaching distributed as seen in the time schedule. Along with writing and publishing scientific articles my intentions are also to interfere with the public debate related to my research.

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