Change and Resistance to Change in Health Care
Inertia in Sociotechnical Systems

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Inertia in Sociotechnical Systems

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Abstract

This thesis explores change and resistance to change of IT systems in organisations from a sociotechnical perspective. The work is drawing on empirical data gathered during two Action Research projects in Swedish Health Care: one regarding the deployment of electronic patient record systems within health care organisations, and the other regarding the deployment of eHealth services geared towards patients and citizens. Resistance to change is classified as an indicator of social inertia, and the concept of counter-implementation, comprising three general strategies to obstruct change initiatives, is used to highlight the political aspects of social inertia. For the analysis, the concept of social inertia is used as a point of departure towards inertia in sociotechnical systems by applying values and principles from sociotechnical systems research, most prominently the interdependence-characteristic. This extended concept is used to show and discuss how IT systems can either enforce change or be a source of inertia preventing change in organisations, and such planned or inadvertent effects of implementing IT systems are discussed as a significant source of user resistance.
inertia  |ɪˈnəәːʃəә|  noun

1. Physics: The property of a body that resists any change to its uniform motion; equivalent to its mass.

2. Figuratively: In a person, unwillingness to take action; indisposition to motion, exertion, or change.
**Preface**

**List of Papers**

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

<table>
<thead>
<tr>
<th>Paper I</th>
<th>Mind the Gap – Towards a Framework for Analysing the Deployment of IT Systems from a Sociotechnical Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Thomas Lind, Åsa Cajander</td>
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<tr>
<td>Abstract</td>
<td>Deployment of IT is little discussed in research literature, despite the fact that a successful deployment encompasses complexities and difficulties well worth investigating. The deployment phase of IT systems can be a make-or-break moment for usefulness of the system due to sociotechnical factors. We argue that there is a gap between the technological artefact produced and the social requirements that govern how well the system will fit in the organisation. Hence, in this work in progress paper we present a framework (the SOT framework) for analysing deployment of IT from a sociotechnical perspective.</td>
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<tr>
<td>My contribution</td>
<td>This paper was planned, discussed and written together with my main supervisor. I am the first author of the paper.</td>
</tr>
</tbody>
</table>

| Paper II | Evaluation of User Adoption during Three Module Deployments of Region-wide Electronic Patient Record Systems |
| Authors | Rebecka Janols, Thomas Lind, Bengt Göransson, Bengt Sandblad |
| Publication | International Journal of Medical Informatics (IJMI). |
Abstract

Background: In Sweden there are modular region-wide EPR systems that are implemented at various health organisations in the region. The market is dominated by four IT systems that have been procured and deployed in 18 out of 21 regions. Methods: In a 2.5-year research study, deployments of three region-wide EPR modules; a patient administration system, eReferral module and eMedication module were followed and evaluated. Health professionals, EPR maintenance organisation, IT and health care managers were observed, interviewed and responded to questionnaires. Results: Although the same deployment process was used during the three deployments, large variations in the units’ adoptions were observed. The variations were due to: (1) expectation and attitude, (2) management and steering, (3) end-user involvement, (4) EPR learning, and (5) usability and the possibility of changing and improving the EPR. Conclusions: If changes in work processes are not considered in development and deployment, the potential benefits will not be achieved. It is therefore crucial that EPR deployment be conceived as organisational development. Users must be supported not just before and during the go-live phase, but also in the post-period. A problem often encountered is that it is difficult to make late changes in a region-wide EPR, and it is an open question whether it is possible to talk about a successful deployment if the usability of the introduced system is low.

My contribution

My main contribution to this paper was through the planning and data collection involved in one of the studied deployments. I was the second author, taking part in discussions, analysis, and writing effort together with the other authors.

Paper III

Development of Novel eHealth Services For Citizen Use: Current System Engineering vs. Best Practice in HCI

Authors

Isabella Scandurra, Jesper Holgersson, Thomas Lind, Gunilla Myreteg

Publication


Abstract

Many new public eHealth Services are now being developed. Often a conventional customer-vendor process is used, where the customer is a public authority, e.g. a county council, and the vendor a commercial actor, e.g. an IT development company. In this case study the engineering process regards a novel eHealth service aiming to provide patients with online access to their electronic...
A complicating factor in conventional customer-vendor processes for public e-services is that “the future user could be anyone”. In the light of best practice in Human-Computer Interaction, this study examines the joint effort of the customer and vendor when developing novel services for citizen use. The results include delimiting factors, recommendations for public authority customers and proposed new actions for the research agenda.

My contribution

In this paper I was the third author. I participated in data collection during three of the six interviews conducted, analysed audio recordings and transcriptions from all interviews and discussed and wrote the paper with the other authors.

Paper IV

Development of Patient Access to Electronic Health Records as a Step Towards Ubiquitous Public eHealth

Authors

Isabella Scandurra, Jesper Holgersson, Thomas Lind, Gunilla Myreteg

Publication

European Journal of ePractice, 20, 21-36.

Abstract

A necessary activity towards moving healthcare services out of the physical premises of hospitals and into patients’ daily lives is to supply citizens with various health services via the Internet, i.e. public eHealth services. However, developing public eHealth services for a large number of heterogeneous end-users is a complex task. This case study investigated the development process of a novel eHealth service that provides patient access to electronic health records, which was developed and recently deployed within the scope of an EU project.

A conventional customer-vendor process was applied that resulted in a high degree of uncertainty regarding end-user needs of this novel service. The development team tried to compensate for this weakness by using agile methods. When developing public eHealth services for citizens, it is imperative to involve potential users, to evaluate the citizens’ needs as a function of benefit, usability and security, and to handle those concepts responsibly throughout the process.

My contribution

In this paper I was the third author. It is mainly based on the same data collection as paper III. I took part in discussions, analysis, and the writing of the paper with the other authors.

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<table>
<thead>
<tr>
<th>Name</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
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<td>PhD in Human-Computer Interaction (HCI), Lecturer at the Department of Information Technology, Uppsala University.</td>
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<td>Isabella Scandurra</td>
<td>PhD in Medical Informatics, formerly at the Department of Information Technology, Uppsala University.</td>
</tr>
</tbody>
</table>
Other Publications Not Included in this Thesis


## Contents

- Introduction .................................................................................................................. 15
- Background and Research Question ............................................................................. 16
- My Position in The Research Area of Human-Computer Interaction ..................... 18
- Research Projects ........................................................................................................ 20
  - IVAN ......................................................................................................................... 20
  - DOME ...................................................................................................................... 20
- Methodology and Methods Used .................................................................................. 22
  - Action Research ........................................................................................................ 22
  - Methods .................................................................................................................... 23
- Theory Used .................................................................................................................. 24
  - Sociotechnical Systems ............................................................................................ 24
  - Inertia and Resistance to Change ............................................................................. 25
- Results .......................................................................................................................... 28
  - Inertia During the Deployment of Electronic Patient Record Systems .................... 28
  - Inertia During the Deployment of eHealth Services ................................................ 30
- Discussion ...................................................................................................................... 34
  - Inertia is Not (Necessarily) a Bad Thing .................................................................. 34
  - A Political Aspect of Change and Resistance .......................................................... 35
  - The Risks of Labelling Sources of Inertia ................................................................. 36
  - Minimum Critical Specification and Designing for Incompletion ............................ 36
  - Evolving the SOT Framework .................................................................................. 37
  - Returning to the Research Question ........................................................................ 37
- Future Work ................................................................................................................... 38
  - Venues for Further Research .................................................................................... 38
- References ...................................................................................................................... 40
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR</td>
<td>Action Research</td>
</tr>
<tr>
<td>DOME</td>
<td>Deployment of Online Medical records and E-health services</td>
</tr>
<tr>
<td>EPR</td>
<td>Electronic Patient Record</td>
</tr>
<tr>
<td>HCI</td>
<td>Human-Computer Interaction</td>
</tr>
<tr>
<td>IS</td>
<td>Information Systems</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>IVAN</td>
<td>IT i Vården, Användbarhet och Nytta (IT in Health Care, Usability and Benefit)</td>
</tr>
<tr>
<td>STS</td>
<td>Sociotechnical Systems</td>
</tr>
<tr>
<td>STSD</td>
<td>Socio-Technical Systems Design</td>
</tr>
</tbody>
</table>
Introduction

A few months following the deployment of a new eHealth service providing patients with online access to their personal electronic patient records (EPRs), the change project’s manager stated that the project had been reported to virtually every national regulating authority except Swedish Customs. Overnight, in the fall of 2012, the eHealth service had empowered Uppsala county’s over 200,000 patients by providing them with immediate access to the county’s public health care organisations’ primary information system (IS). Many health care professionals were unhappy about this considerable change to the relationship between health care and patient.

The introduction or alteration of technology in organisations has the potential of significantly changing the ways in which people interact with each other, how tasks are performed, and how work processes can be designed. If a change project involving new technology is not carefully managed, taking this into account, the resulting change may be of such magnitude that the organisation cannot cope. As a natural safeguard against such considerable change, people have a tendency to resist change that can be perceived as a great leap, preferring small steps where uncertainty of the outcome is at a minimum. However, as in the case above, even ardent resistance can be nearly futile if those controlling the change are convinced that the change is necessary.

Technology can be used deliberately as a tool to enforce (or prevent) change (Winner, 1980), but even if the change is inadvertent, those affected will become wary when future change projects are announced. Swedish health care is subject to constant change, due to the continuous struggle to become increasingly efficient and provide even better care. Technology, and more specifically information technology (IT), is frequently a part of this struggle. However, IT in health care has gained a reputation of being hard to improve once introduced, and to bring unforeseen changes to existing work processes. This means health care professionals must find ways to improve despite the IT systems, instead of with the support of them (Janols, 2013).

In this thesis I analyse two sides of IT in health care, the case above regarding a controversial eHealth service geared towards patients and citizens, and a collection of cases regarding the deployment of IT systems used by health care professionals. I do this with the aim of gaining a deeper understanding of how change and resistance to change relates to the introduction or alteration of IT systems.
Background and Research Question

Within the field of Human-Computer Interaction (HCI), the idea is quite common that an information technology (IT) system’s level of usability\(^1\) is a major determinant for the rate and extent of user adoption. I argue, however, that regardless of an IT system’s level of usability, any change project entailing the addition or alteration of an IT system in an organisation must also overcome inertia generated from many sources beyond lack of usability.

Since the proliferation of IT in the workplace, change projects in organisations typically entail changes to IT systems in one way or another. Even if the main purpose of a change project is to migrate from one technical system to another, with no intention of altering work processes, what inherently follows is change in a much wider sense. The change is not only technical, but also social and organisational. What is being changed is not only a technical tool used to perform or support work but also the work processes wherein the work is to be performed, as well as the social structures of the people performing and supporting that work.

Hence, the subject of this thesis is change related to IT systems in organisations. I approach this subject from a sociotechnical perspective; meaning that I regard the organisations I study as sociotechnical systems where humans and technology are highly interdependent agents and where change affects all parts of the system. I add to this the concept of inertia, extending on the use of the concept of social inertia by Keen (1981) in relation to the resistance to change in social structures. In this thesis I widen the inertia concept to not only encompass the preservation of social structures, but the preservation of a status quo in a sociotechnical system in general. I believe that a sociotechnical perspective in combination with the concept of inertia can provide a useful perspective on change involving IT systems in organisations. Using this perspective to increase our understanding of the change process as such could serve to make the complexities of change involving IT systems easier to communicate, and thereby also more manageable.

\(^1\) The International Organization for Standardization defines usability as "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." (ISO/IEC 9241-11, 1998)
My research question is thus:

How can resistance to change related to IT systems be understood from the perspective of sociotechnical systems and inertia?

The empirical base for the thesis consists of data from two action research (AR) projects within the Swedish health care sector, and four papers with different contributions towards my research question. Paper I is theoretical and describes the framework that evolved into the perspective used in this thesis. Paper II regards the deployment of EPR systems used by health care staff in their daily work. Paper III and Paper IV both regard the deployment of the eHealth service mentioned at the beginning of the introduction.
My Position in The Research Area of Human-Computer Interaction

Human-Computer Interaction (HCI) is a relatively young research area and could be considered an organic meld of a number of more traditional research areas engaging in the study of information technology (IT) in use. With this mixed heritage it is no surprise that there are many interpretations of what HCI is and how it relates to other research fields (e.g., Baxter & Sommerville, 2011; Kuutti & Bannon, 2014).

The field of HCI has grown substantially over the last decades. Given the proliferation of information technology (IT), going from particular to ubiquitous over roughly the same period, this increased interest in the field should probably not come as a surprise. Rogers (2012) provide a telling description of the changes to the field:

“Judging by the diversity of papers that are now accepted at the annual flagship U.S. conference, CHI, and its galaxy of sister venues (e.g., ItalCHI, NordCHI, SouthCHI, OzCHI), there is no longer a coherent set of aims or goals, or accepted classification of contributing disciplines. It seems anything goes and anyone can join in. The early mantra of HCI ‘know your user’ has in a few years all but been superseded by the socially aware slogan ‘make an impact.’ Instead of striving to fix interfaces so they are easy and obvious how to use, the community is looking at how it can transform the world to be a better place.” (Rogers, 2012, p. xii)

While I cannot say that attending CHI in 2013 gave me the impression that the mutual aim of the HCI field is to transform the world into a better place, I agree with Rogers that it is hard to discern any coherent aims, goals or even contributing disciplines.

Another narrative on the changes in science overall is given by Shneiderman (2008) in his article Science 2.0, where he calls for a new kind of science in the wake of Web 2.0. He argues that understanding the new collaborative sociotechnical systems made possible by IT requires new ways of performing research studies, as a complement to the predominant:

“Science 1.0 heroes such as Galileo, Newton, and Einstein produced key equations that describe the relationships among gravity, electricity, magnetism, and light. By contrast, Science 2.0 leaders are studying trust, empathy, responsibility, and privacy. The great adventure for the next 400 years
will be to define, measure, and predict the interaction among these variables so as to accelerate scientific discovery, engineering innovation, e-commerce, and education.” (Shneiderman, 2008)

Similarly, but focusing on a comparatively narrow time-span, Kuutti and Bannon (2014) argue that there are two paradigms within HCI: the interaction paradigm and the practice paradigm. The former is described as the “prevailing mainstream paradigm” of HCI where methods traditionally come from psychological sciences; the studies are primarily short-term, conducted in a laboratory-like setting, and revolve around individuals being observed whilst engaging in predetermined experimental tasks. The latter is described as a paradigm that “examines historical processes and performances, longer-term actions which persist over time, and which must be studied along the full length of their temporal trajectory”. The methods in this paradigm have predominantly been qualitative, extended over time, extending the focus to an overall activity, involving people and artefacts as well as organisational routines and daily practices. (Kuutti & Bannon, 2014)

According to Kuutti and Bannon, (2014) the diversity in the field of HCI can be explained by this emergence of two fundamentally different lines of enquiry. For me, coming from a background in sociotechnical systems (STS), it feels natural to favour topics that inherently involve the struggle to manage the complexity of real-life contexts over topics requiring a laboratory setting and the controlling of as many sources of variance as possible. Hence, I identify myself as being part of the practice paradigm.
Research Projects

In this section I present the research projects within which I have gathered the empirical data informing this thesis. The first project, IVAN, regards the deployment of electronic patient record systems within health care organisations, while the other one, DOME, regards the deployment of eHealth services geared towards citizens.

IVAN

The Swedish acronym IVAN (originally “IT i Vården, Användbarhet och Nytta”) translates into “IT in Health Care, Usability and Benefit”. This was an action research (AR) project where researchers within Human-Computer Interaction (HCI) at the Department of Information Technology, Uppsala University, collaborated with the Uppsala County Council.

The research studies conducted within the project focused on the regional health care organisations’ common electronic patient record (EPR) system and the usability issues related to this system, with the AR aim of identifying and recommending changes necessary to improve efficiency and effectiveness when working with the EPR system. Empirical data was collected through studies at the county’s main health care providers, including a university hospital, a smaller regional hospital and several primary care facilities. Financial support for the research project was provided in part by the county and in part by the Department of Information Technology.

The IVAN project involved one senior professor, two senior researchers, one PhD student and six master level students. I was one of the students writing my master thesis based on a study in the project. After the project ended I became a PhD student and co-authored Paper II, which is based on experiences from my thesis project and a number of other studies within IVAN.

DOME

DOME is the selective acronym for “Deployment of Online Medical Records and E-Health Services” and is the name of a collaborative AR project between Uppsala University, the University of Lund and the University of
Skövde. It is funded by the Swedish Governmental Agency for Innovation Systems, VINNOVA.

The main purpose of the DOME project is to build a knowledge base on the implementation and use of eHealth services, primarily in Sweden. The research in the project is performed through studies in cooperation with different agents involved in the launch of services providing patients with access to their own health records over the Internet, and other eHealth services. Though the main focus of DOME is on the national deployment of eHealth services in Sweden, the project also has international ties through collaboration with the EU project SUSTAINS, coordinated by the Uppsala County Council and comprising 16 parties in 11 countries.

The DOME project is comprised of 16 researchers with backgrounds in many different fields, including health informatics, HCI, information systems, library and information science, and business studies. Research studies are divided into three work packages, focusing on topics related to patients and relatives, professions and management, and development and implementation respectively. My main involvement in the DOME project has been through the work package focusing on development and implementation, within which Paper III and Paper IV were produced.
Methodology and Methods Used

I have conducted studies within two Action Research (AR) projects; neither of these projects strictly follow any particular approach to AR, so what is presented here is a synthesis of guiding influences. During my research studies and the writing of this thesis I have used a mix of data gathering techniques, mainly relying on the gathering of qualitative data, and applied methods for qualitative content analysis.

Action Research

Action research (AR) is a research methodology where the research project has the dual aim of conducting research studies while at the same time solving a problem in the studied context (McKay & Marshall, 2001). The approach is built on the idea that through collaboration with practitioners and the sharing of knowledge and experiences, the researchers can aid in the developing of a solution while simultaneously developing theory around the problem being solved. The focus on collaboration is also highlighted by Rapoport (1970), defining AR as a methodology that “aims to contribute both to the practical concerns of people in an immediate problematic situation and the goals of social science by joint collaboration within a mutually acceptable ethical framework.”

According to Rasmussen (2004) the researcher in an AR project may take on different roles, such as facilitator, mentor, conflict mediator, knowledge generator or educator. Which role the researcher adopts may vary throughout a research project depending on the current phase of the project and on conditions given by the studied problem and its context (such as scale, complexity and surrounding organisational structure). The active and deliberate involvement in the studied context in this manner is unlike many other methodologies where intervention is prohibited and the researcher is expected to observe with as limited effect on the observed phenomena as possible. In contrast, intervention is at the centre of AR, combined with studying and learning from the act of intervening (Oates, 2005).

There are several instantiations of AR that widen the conceptual scope of the methodology through a variation of definitions of e.g. the nature of the problem addressed, the relation between researcher and subject, and the nature of science itself (Elden & Chisholm, 1993). Despite this diversity one
can argue that there are some common features and particularly a common view of how to conduct research. Among the different variants of AR, Rasmussen (2004) has found three features that unite them. The first is the participatory nature of the methodology and the synergistic relationship of research informing practice and practice informing research. The second is the process of data collection, which is often an integral part of the research process and as such one which Rasmussen (2004) argues is not strictly formalised and bound by any particular rules. The third common feature is that the researcher often takes, and shifts between, different roles in the project as mentioned earlier.

Methods

The studies I have conducted have been predominantly qualitative, based on qualitative content analysis (Hsieh & Shannon, 2005) of interviews. The one exception is the study I designed and conducted in Paper II, which also included the use of surveys to enrich and support the data gathered through interviews and observations. In this study the method of analysis was inspired by grounded theory (Charmaz, 2006; Glaser & Strauss, 1967). Paper III and IV are both based on the same data gathered through six interviews, but analysed from different perspectives. Since Paper IV was written later there were also new developments such as debates and articles in the media, experiences shared during meetings with researchers conducting studies in parallel within DOME, and other unstructured and experiential sources of data that influenced the analysis. Though Paper I has no data gathering or analysis of data reported, and is technically not part of any research project in particular, this paper could also be considered to be influenced by experiences drawn from the research projects I have been a member of.

For Paper II, III and IV, the interviews were conducted in a semi-structured fashion with open-ended questions or themes drawn from an interview guide, and audio recorded. The analyses have then been performed on written transcripts produced from the audio recordings, both by me alone and in collaboration with other researchers. During observations I have used a research journal to keep notes.

When writing the licentiate thesis the data has been revisited using the perspective of inertia in sociotechnical systems, following a literature review of these and related concepts. In this phase the writing process itself has also been an important tool for analysis, revisiting the papers included in this thesis, supported by the use of mind maps to visualise and categorize data.
Theory Used

In this section I present the theories I have used when studying the change and resistance to change of IT in organisations. Neither of the subsections is exhaustive but together rather serve to provide the reader with enough insight to understand the approach I have taken and the contribution this may bring to the field of Human-Computer Interaction (HCI).

Sociotechnical Systems

“The most important thing that socio-technical design can contribute is its value system. This tells us that although technology and organizational structures may change, the rights and needs of the employee must be given as high a priority as those of the non-human parts of the system.” (Mumford, 2006)

Since the inception of sociotechnical systems (STS) research in the 1940’s at the Tavistock Institute of Human Relations, UK, by pioneers such as Eric Trist, Ken Bamforth and Fred Emery (Emery & Trist, 1960; Trist & Bamforth, 1951), the concept and its guiding principles have been formulated, reformulated, extended and revised by different authors and for different purposes (e.g., Baxter & Sommerville, 2011; Cherns, 1976, 1987; Clegg, 2000; Cooper & Foster, 1971; L. E. Davis, 1977; M. C. Davis, Challenger, Jayewardene, & Clegg, 2014; Eason, 1988; Klein, 2014; Mumford, 2006). However, the core concept has remained quite constant considering the proliferation of information technology (IT) in organisations and the evolution of work, workplaces and society in general. By the core concept I refer to the idea that the people and technology in a work system are interdependent, as formulated here by Klein (2014):

“Each affects the other. Technology affects the behaviour of people, and the behaviour of people affects the working of the technology. It is inevitable, it is a real part of the situation, and one therefore needs to take account of how they affect each other.”

Traditionally, STS research has an inherent action research (AR) agenda, striving towards an improved quality of working life through the design or redesign of work systems, and by extension also organisations as a whole,
guided by this idea of interdependence (Mumford, 2006). The practice of designing a work system in this way is referred to as sociotechnical design, or more explicitly sociotechnical systems design (STSD). The accumulated theories and principles for STSD were synthesised and described by Cherns (1976) and revised one decade later (Cherns, 1987). I will not give a detailed recount of these principles here; I refer the interested reader to Cherns (1976, 1987), or for a more lightweight recount to Mumford (2006). The principles served to increase democracy and efficiency through the design of work, to regard humans as complementary to machines instead of subordinate, and to move away from “the dictatorship of the moving assembly line.” (Mumford, 2006) However, the sociotechnical principles have been critiqued for being too philosophical to serve as principles for design and successful application has thus proven dependent on the principles being distilled into more concrete methods (Baxter & Sommerville, 2011; Mumford, 1993). Revisions have also been proposed to accommodate for software development as a necessary part of the design process (e.g., Baxter & Sommerville, 2011; Clegg, 2000).

Closing the gap between the research field of human-computer interaction (HCI) and STS, Baxter and Sommerville (2011) point out that several approaches within HCI have been influenced by STS. One notable example of this is the key principles formulated by Gulliksen et al. (2003), where holistic design and the consideration of work context and social environment are explicitly included.

**Inertia and Resistance to Change**

“‘Social inertia’ is a complicated way of saying that no matter how hard you try, nothing seems to happen.” (Keen, 1981)

Keen (1981) explains the inherent difficulties of changing information systems\(^2\) (IS) in organisations as a result of social inertia caused by different forms of resistance, with an emphasis on resistance through counter-implementation. He identifies that resistance to IS change stems from a view of the decision-making process as unfit to be formalized through the use of technology:

“Regardless of how individuals should make decisions, it seems clear that the process they actually rely on do not remotely approximate the rational ideal. This gap between the descriptive and prescriptive is a main cause of inertia.

\(^2\) *Information systems*, in this context, refers to systems designed to support decision-making, and the management of an organisation, including both information technology (IT) and necessary business processes.
According to Keen (1981), the contemporary body of research on implementation of IS fails to take into account the full complexity inherent in implementations. Beside the technical aspect, the development and implementation of IS also has an intensely political aspect to it. Referring to the research of Bardach (1977) into political studies and the area of political programmes and policy change, Keen (1981) finds that the strategies presented by Bardach (1977) on how to counter change efforts in politics also apply when implementing IS in organisations.

Bardach (1977) identifies three general strategies for countering change initiatives: diverting project resources, deflecting goals, and dissipating energies. In my interpretation, the diversion of project resources strategy revolves around supporting a project while simultaneously trying to get more back than you have invested, making sure that the parts of the project that benefit you receive ample resources. The second strategy, deflecting goals, goes one step further and takes advantage of any ambiguity or lack of clear mandate to shift the goals towards one’s own, recruit allied stakeholders to the project, or assume leadership of the project completely. The third strategy, dissipating energies, has a great deal of focus on creating inertia, slowing down project progress as much as possible, or at least until one’s own agenda has been fulfilled. These strategies can either be used to steer a project towards one’s own goals, or to make sure that the project is unsuccessful by impeding progress or completion. Keen (1981) identifies an interesting common characteristic of these strategies:

“A central lesson to be learned from examples of successful counterimplementation is that there is no need to take the risky step of overtly opposing a project. The simplest approach is to rely on social inertia and use moves based on delay and tokenism. […] If more active counterimplementation is needed, one may exploit the difficulty of getting agreement among actors with different interests by enthusiastically saying, ‘Great idea – but let’s do it properly!’ adding more people to the game and making the objectives of the venture broader and more ambitious and consequently more contentious and harder to make operational.”

Keen (1981) suggests that IS implementations are most effective when conducted as small-scale projects, propose incremental change, and rely on face-to-face facilitation. He notes that most of the counter-implementation strategies identified by Bardach (1977) target ambiguity and lack of control, rendering a project particularly vulnerable until its broad goals have been turned into operational objectives and a clear mandate for change. Large-scale change is seen as a process of coalition building, in need of senior-
management leadership with the formal authority required to negotiate with all affected parties. If politics are recognised as a necessary part of IS development and implementation, as a process of gaining support, commitment, and momentum for change, the organisational mechanisms will adjust naturally. (Keen, 1981) The same conclusion is reached by Hirschheim and Newman (1988) while studying user resistance to IS development in practice:

“The development and implementation of computer-based information systems is a type of major organisational change. Only those development strategies which view such change in terms of social and political processes are likely to prove satisfactory.”

My interpretation of Keen (1981) is that counter-implementation can be described as a form of resistance to change, and that resistance in general can be seen as activities that exacerbate social inertia. In turn, I regard social inertia as a phenomenon influenced by any activity (or lack thereof) prompted by a status quo bias (Samuelson & Zeckhauser, 1988; Kim & Kankanhalli, 2009) in an organisation, and resistance to change is thus a symptom of status quo bias. The concept of social inertia itself, which is not explicitly defined by Keen (1981) beyond the opening quote of this section, I interpret as the quality of a social structure which determines the effort necessary to alter the current trajectory of that structure. By current trajectory I refer to the idea that most, if not all, social structures are constantly changing and in this sense social inertia can be described as the quality that conserves this process.

Besides the development and implementation of IS in organisations being influenced by social and political processes, path dependence (Burns & Scapens, 2000) can be used to highlight that the scope of a change initiative is also limited by the current state of an organisation’s existing procedures and institutions. I regard technology as one major factor influencing inertia and path dependence in organisations, recognising that technology can be used as a tool to control the direction of future organisational development (cf. Winner, 1980).

As a widening of the original concept, combining my interpretation of the above theories, I will use the term inertia to refer to the idea that existing information technology, procedures and institutions, and social and political processes influence the possible rate of organisational change. Thus, the combined inertia in a sociotechnical system stems from many sources, and may also include sources external to the system, each of which can be considered to have its own inertia preserving its current state. While these sources may be seen as separate, the idea of interdependence (e.g. Klein, 2014) from sociotechnical systems research is important to keep in mind when describing or analysing inertia.
Results

How can resistance to change related to IT systems be understood from the perspective of sociotechnical systems and inertia?

This is the research question I set out to answer in this thesis, and in this section I present my results based on the analysis of empirical data from two action research (AR) projects. The subsections are divided based on the focus of the AR projects: the first one regarding the deployment of electronic patient record (EPR) systems within health care organisations, and the other regarding the deployment of eHealth services geared towards patients and citizens.

Inertia During the Deployment of Electronic Patient Record Systems

Even though the health care organisations studied in Paper II used a normative deployment process that depended on local involvement and commitment, utilizing local teams to adapt the prescribed steps and facilitate change, it was not enough to actually normalise the deployments. We identified five areas of variation affecting user adoption of electronic patient record (EPR) systems in these organisations and conclude that each category can either enable the change process or act as a barrier against it. Reviewing these five categories from the perspective of inertia in sociotechnical systems, they can be described as indicators of inertia and whether they are characterised as barriers or enablers expressed as dependant on whether the level of inertia is high enough to prevent the proposed change.

The first two categories identified in Paper II (1 - expectation, attitude and outcome, 2 - management and steering) are both indicators of inertia mainly generated by humans not supporting or actively resisting the planned change. High expectations and a positive general attitude would indicate that social inertia is not generated by the first category, characterising it as an enabler. However, if expectations are not met social inertia is generated as attitudes turn negative, and the enabler turns into a barrier. In our case regarding the implementation of an eReferral module in the EPR system, social inertia was not initially estimated to be high as physicians were positive towards the module. However, the change in work practices following the
deployment was significant, the new routines rendering physicians stressed and vulnerable, which generated enough social inertia to result in poor user adoption with users circumventing the EPR system or using it in an unintended fashion. This also exemplifies the interdependence between sources of inertia as the technological implementation could be seen as successful (the eReferral module was technically in place) but the planned change was dampened and partial from a social and organisational perspective. In the case regarding the implementation of an eMedication module, health care staff’s view of the expected outcome was to a limited extent negatively influenced by rumours from colleagues at other health care organisations. The prevailing attitude, however, was a sober notion of the eMedication module being a necessary step towards more efficient management of medication, but that there would first be a transition period where the new work routines would prove inferior to the old. In this case social inertia was primarily generated by preconceptions of the module as having a low level of usability and a belief in high technological inertia fuelled by poor feedback on earlier requests for improvements.

In the latter three categories (3 - end-user involvement, 4 - EPR learning, 5 - usability and the possibility of changing and improving the IT system) technology becomes more visible as a contributor to inertia; for example in the sense that it to a higher extent is the actual characteristics of the system that influence the health care staff’s opinion, rather than e.g. preconceptions guided by rumours or personal conviction. The fifth category, and specifically the possibility of changing the IT system, illustrates the interdependence between technological inertia and social inertia in the health care organisations as the high technological inertia exemplified by long development cycles increased social inertia through poor feedback on requests for improvements. Included in the normative deployment process was the need for educational sessions in the new IT system for end users, relating to the fourth category of EPR learning. These sessions focused on familiarising the staff with all of the new functionality. However, they did not become practiced in how they were to use the IT system in their own work context. Learning how to perform basic functions in a classroom setting did not translate into knowing how to use the system in clinical practice. In this sense the educational sessions did not serve to mitigate organisational inertia by stimulating the staff to reflect on how their existing work environment would have to change to accommodate the new IT system and work routines. This also relates to the third category of end-user involvement, as an opportunity for the health care staff to reflect upon the proposed change and become an active designer of that change and not primarily a recipient. However, from the cases in Paper II we found that users, and physicians in particular, were rarely involved. This was explained by the staff as a result of not being asked, a belief in participation not having any effect in terms of significant improvements, or finding it hard to participate due to their heavy workload.
Common for all the cases in Paper II is that experiences from earlier introductions and changes to the EPR system had already negatively affected the nurses’ and physicians’ perception of change initiatives involving IT. Hence, a potentially significant amount of social inertia can be considered a result of the situation left by earlier change initiatives.

Inertia During the Deployment of eHealth Services

As the coordinating member of the EU project SUSTAINS³, The County Council of Uppsala initiated a project to develop and deploy an eHealth service enabling patients treated at any of the county’s public health care organisations to access their personal health records⁴ online, going live in late 2012. Previously, access to these records required a request for a printed copy to be sent to an administrative unit where the patient’s records could first be censored, removing any parts considered potentially detrimental to the patient’s health if revealed to the patient. In practice most records were not deemed necessary to censor, with the exception of a few departments (e.g. child and youth psychology, women’s clinics, and clinical genetics) where the physician in charge of the patient would first be consulted. For this reason these particular departments were omitted from the eHealth service while the rest provided a virtually unaltered version of the patient’s records, copied from the electronic patient record (EPR) system used by health care staff. Initially there was a forced 14 day waiting period, a respite, before a patient could see new record entries through the service, the purpose of which is to give health care staff sufficient time to first deliver any news to the patient face-to-face or over the phone. But as of the spring of 2014 each patient can choose to deactivate the respite, thus gaining immediate access to all new records. This considerable change in accessibility, and in particular the possibility of patients’ reading news of their health directly from their health records before being contacted by health care staff, was one of several significant causes for concern among health care staff in the county. While there were also those who regarded this new eHealth service as a step in the right direction, the social inertia related to this change can nevertheless be described as high within the health care community.

Opinions differ on whether health care staff representatives were invited by the change project to participate in the development and deployment of this novel eHealth service. The project’s representatives maintain that they did invite the health care staff representatives, while the staff representatives maintain that they received no such invitation. Strictly speaking, there were

³ A EU project with the aim of implementing patient access to personal health records.
⁴ These records include diagnoses, medical notes, lab test results, referrals, and drug prescriptions.
still representatives from health care in the change project: one medical advisor, and one medical doctor (of which the latter had experience of providing patients at his private practice with online access to their EPRs as part of a pilot project initiated in the late 1990’s). However, these two were considered by the health care staff representatives to be biased and not acting in the best interest of neither the health care staff nor the patients. The atmosphere between members of the change project and health care staff representatives could in general be described as negative and uncooperative.

The change project organised focus groups including representatives from both health care unions and patient associations, and had usability experts added to the development team to aid in the identification of requirements for the service. As is concluded in Paper III, however, the manner in which these activities were conducted could not be considered consistent with best practices in HCI. The functionality to be offered by the service having been collaboratively specified by the SUSTAINS project, it is hard to say what impact the use of HCI best practices in Uppsala could have had other than an improved interface, which received very little attention in the debate sparked by the deployment. The public debate surrounding the eHealth service regarded possible consequences of the provided functionality, through topics such as whether patients’ health was endangered by the risk of patients misinterpreting medical jargon or by reactions to a negative test result or diagnosis, whether health care staff would be swamped by questions from patients concerning the content of their records, or whether health care staff was put at risk of becoming targets of aggression from patients aggravated by perceived errors in their records. For more details on the arguments used by different stakeholders I refer the interested reader to the recount by Erlingsdottir and Lindholm (2013).

The eHealth service constituted a politically supported change in the health care staff’s work practices towards using the EPR system as a communicative tool not only between themselves but also towards patients. As mentioned above, the social inertia generated in response to this change was considerable. However, since the change project had political support, on a local, national as well as international level (through EU directives), and because cooperation between the project and health care staff representatives was low, the social inertia generated by the health care community had little effect on the change project. Another reason for this lack of effect was that health care staff is not the primary users of the eHealth service, so resisting change by not using the service was not an available option. However, being the content providers of the patients’ health records, health care staff could affect the service by changing the way they document their work in the EPR system. That such changes have already begun to take place has been confirmed, but their effects have not yet been studied.

A rationale for not including the user perspective expressed by the project manager was that no one could know what features would be desired by a
future user, so the project’s proposed features were as good a place to start as any. While the concerns of the health care staff did not gain enough traction to take the service offline, the project manager states that they monitored its usage closely following the deployment, ready to pull the plug at the first sign of trouble. But no such signs came, and instead the project continued to implement new features while continuously gathering usage statistics. Besides using these statistics to monitor the service for internal purposes, they were also included at presentations given by the project manager and in the media to counter the voices of health care staff opposing the service. Along with the deployment of the service followed spontaneous feedback from patients to a dedicated e-mail address owned by the project. According to the project manager, most of the feedback received has been from patients positive towards the service, and samples of such emails have also been used when defending the functionality of the service.

Even though the eHealth service has been deployed and its usage is still increasing steadily after 18 months, social inertia in the local health care community remains significant. With several other Swedish counties and regions planning or actively deploying similar services a lesson learned from Uppsala seem to be to maintain a more collaborative relationship between change project and health care representatives. However, in the Skåne region, where a similar service was deployed in February of 2014, this appears to have contributed to a considerable reduction of provided functionality, at least initially. If this is indeed a concession to concerns presented by the Skåne health care community it can be described as the social inertia having a more direct influence on the change project compared to the case in Uppsala. However, as the Uppsala and Skåne cases are also different in many other regards, e.g. in terms of existing IT infrastructure to integrate the eHealth service with, the difference in functionality also stems from other reasons or sources of inertia.

For the Uppsala change project itself, technological inertia can be described as low: they were in close contact with the development team, working in three week sprints to deliver improvements and new functionality at a relatively high pace, and existing IT infrastructure made integrating the EPR system with the eHealth service unproblematic. For the Uppsala health care staff, on the other hand, technological inertia can be described as high: they had very limited influence on the development, all concerns and reservations being subject to the change projects rationale of first testing the planned functionality by delivering it to the population. This contrast serves to illustrate the interdependency of different sources of inertia, and for different agents. The technological inertia of the eHealth service is subject to the social and organisational structures surrounding it, and is thus different depending on the agent attempting the change. The actions taken by both parties can be explained as either serving to change these structures, or to preserve them. Actions toward change, trying to restrict the eHealth service, can
be described as the public voicing of concerns, influencing public opinion and politicians, and also the reporting of the change project to what the change project’s manager describes as every national regulatory agency except Swedish Customs. The proponents of the eHealth service tried to preserve the structures by arguing that many of the voiced concerns had not been realised following the deployment, and that the benefits the service brings to patients are appreciated. As of the printing of this thesis in May of 2014, the situation in Uppsala regarding the eHealth service and the relationship between change project and health care staff remains much the same.
Discussion

In this section I will discuss the results in relation to my research question and the theories I have used. I will also attempt to discuss the implications of the results in a wider context.

Inertia is Not (Necessarily) a Bad Thing

From the previous section, and the recounts in Paper II-IV, it might look like our health care organisations are dominated by excessively conservative individuals, resisting all change projects that might jeopardise existing social and organisational structures. However, the majority of health care staff I came into contact with during the studies included in Paper II were positive towards change and the proliferation of IT in health care, as were many of the physicians voicing their concerns over the eHealth service in Paper III and Paper IV. The conflict seems to lie rather in how this change is realised, and how change projects generally have been managed thus far.

Health care organisations are under constant pressure to increase efficiency and cut spending while simultaneously treating more patients and providing better care. This means work processes are constantly changing, regardless of whether or not they include IT. Why then, is change involving IT such a challenge? I believe one clue lies in the lack of stakeholder participation during development. One significant drawback of IT systems is that they generally prescribe *how* something is to be done, rather than defining what needs to be done and leaving the *how* to be determined by the user (as discussed e.g. by Cajander, 2010). From this follows that if the user was not included in the design process, s/he has had no or only indirect impact when formulating the *how*. Hence, with the deployment of a new IT system follows restrictions on the design of the whole work process, subject to the design of the IT system. In this way the deployment of a new IT system, or significant alterations to an existing one, may have severe consequences if the impact on work processes have not been carefully planned and prepared for. In the absence of such preparations, social inertia in the form of ardent user resistance can be thought of as a natural response to defend against the unknown.

Considering that the consequences of poorly prepared alterations to work processes in health care may lead to negative effects on patient wellbeing, it
is not surprising that health care staff are sceptical towards changes that are not incremental and relatively uncontroversial. Especially as the changes brought on by technical systems tend to be hard to revert once in place, as exemplified by the results presented in this thesis and discussed e.g. by Winner (1980). In this sense, inertia can be seen as a mechanism safeguarding a sociotechnical system from change, for better or for worse.

A Political Aspect of Change and Resistance

One could describe the strategies used by the health care staff representatives as examples of counter-implementation (Bardach, 1977), with all the negative connotations that this concept brings with it. However, one could also frame it in more positive terms: that the resistance of health care staff is necessary to protect their work processes, and by extension the wellbeing of the patients, from uncontrolled change. Likewise, the actions taken by the change project implementing the eHealth service could either be described as a successful outmanoeuvring of critical stakeholders whilst maintaining political favour; or it could be framed as the successful empowering of patients for the benefit of the relationship between patient and health care. Whichever is the most fitting description, or whether counter-implementation is an applicable term, it is safe to say that Keen (1981) was justified in describing the implementation of information systems (IS) as highly political.

The wellbeing of the patient might be the most frequently used argument related to change in health care. Interestingly, it is used by both opponents and proponents of change. The proponents claim that change is needed to improve the wellbeing of patients, perhaps by making some process more efficient, thus freeing resources and increasing capacity, or perhaps by reducing the error rate. The opponents hold firm that the proposed change is unlikely to bring the expected benefits, arguing that it is more likely to endanger the wellbeing of patients than improve it. For someone not familiar with the health care process in question, or with the proposed change, these arguments have a tendency to cancel each other out, leaving the wellbeing of the patient a moot point in the debate. With the methods for counter-implementation by Bardach (1977) in mind, I would characterise this as belonging to the dissipation of energies strategy. In theory it would seem a very hard argument to counter, it being politically unthinkable to overtly support a course of action endangering the wellbeing of patients, or vice versa. In light of this, using the same argument to mean the opposite seems to be quite an efficient strategy to defuse it.
The Risks of Labelling Sources of Inertia

There is a risk when labelling and differentiating between types of inertia that we forget the inherent interdependence of all sources of inertia in a sociotechnical system. At the face of it we could label the slow processing of requests for improvements in an EPR system as a source of technological inertia in a health care organisation, regarding the health care organisation as our sociotechnical system. But if we look closer at this technological inertia, we might find that it to a large extent is a result of social and organisational inertia generated by the bureaucratic processes of negotiation between the vendor organisation and several health care (customer) organisations on what revisions to include in the next release and who should finance them. This brings us outside of our definition of the singular health care organisation as our sociotechnical system, a change of perspective. While it might make sense to assign a certain label at one level of analysis, or from the perspective of a certain agent, this should be re-evaluated if we switch to another perspective or level where the boundaries of our sociotechnical system under study might have changed.

Minimum Critical Specification and Designing for Incompletion

Changes to work processes not prompted by, or entailing, changes in IT infrastructure can be tailored by staff to fit the organisation, the level of tailoring then being contingent on whether the directive from management is formulated in terms of what to achieve, or how. This is in essence one of the sociotechnical principles for design formulated by Cherns (1976, 1987), i.e. that of minimum critical specification, which states that while there is a need for a clear objective, specifying the essential, the decisions related to how that objective is to be reached should be left to the one(-s) assigned the task. Of course, modern health care delivery hinges on clearly defined routines and regulations, but while many of these may be decided upon organisationally far away from the task at hand there are also those that can be redesigned locally. This ability of redesigning work processes by altering routines and regulations are akin to the sociotechnical principle of incompletion (Cherns, 1976, 1987): regarding design as an iterative process that should never be considered finished, but rather that the outcome of a completed iteration should be considered as input for the next. However, when an iteration tends to take anywhere between six months and several years before completion, as has been my experience of enterprise-scale health care IT systems, it is no wonder health care staff consider their IT systems hard to improve. With the continuing spread and adoption of agile software development methods in vendor organisations, it will be interesting to see if this
leads to an increased delivery frequency or if the bureaucracy of the customer consortiums keeps technological inertia high from the perspective of health care staff.

Evolving the SOT Framework

The SOT framework presented in Paper I illustrates the concept of a sociotechnical gap, located in the middle of the social (S), organisational (O) and technical (T) aspects from which we chose to regard organisational change. We proposed the concept of inertia to reflect the relative and varying ability of these three aspects to adjust with respect to the other two. The sociotechnical gap could thus be described as a result of the collective inability of these aspects to reach a middle ground within an organisation. The result of any aspect being inflexible would be a corresponding increase in the sociotechnical gap and the suboptimal performance of the sociotechnical system.

The concept of inertia in sociotechnical systems, as it is presented in this thesis, differs from the framework in Paper I in that the use of explicit aspects has been removed in favour of underlining the interdependency-characteristic from sociotechnical systems research (e.g., Klein, 2014; Mumford, 2006). As a consequence of the explicit aspects being removed, although still being used, the concept of the sociotechnical gap was dropped as well. Similarly, however, it is still an implicit part of the concept of inertia as it has been defined in this thesis.

Returning to the Research Question

In the introduction to this thesis, I state that my aim is to gain “a deeper understanding of how change and resistance to change relates to the introduction or alteration of IT systems”. I believe that the use of the concept of inertia in sociotechnical systems has enabled me to successfully pursue this aim. In essence, the answer to my research question is the application of the concept as I have done in this thesis: I have used it as a retrospective analytical tool, through which I have gained a deeper understanding of the change efforts studied and described here. The concept does not explain the motivations or reasons for change and resistance to change related to IT systems in organisations, nor does it prescribe any particular methods for minimising (or maximising) inertia. However, I believe that by using it to identify both known and potential sources of inertia when planning for change, the concept of inertia in sociotechnical systems can be used to illustrate how complex a change effort can become, and how even a seemingly trivial change may have a considerable amount of stakeholders and dependencies affected by (and affecting) it.
Future Work

This licentiate thesis marks the halfway-point on my progression towards a PhD degree. As such, it is in a sense an unfinished product and I am looking forward to continuing my research on the subject of change and resistance to change related to information technology (IT) systems.

Continuing on my research education, I find that I need to position myself epistemologically, which I have not explicitly done in this thesis. Further, there is always more previous research relevant to study (for instance, there are probably those that find this thesis in want of references to research specific to the health care area), and more theories that could be included and built upon. Such theories (or areas) may e.g. include a more thorough look into path dependence (Burns & Scapens, 2000), contingency theory, the social construction of technology, the social shaping of technology, and participatory design.

Venues for Further Research

In this thesis the use of previous research on the subject of sociotechnical systems (STS) has been somewhat limited, included rather as a foundation of values, which is perhaps not that strange considering the critique against STS for being too philosophical to be readily applied. However, one aim of my future work will be to track the legacy of STS into contemporary applications of human-computer interaction and participatory design, to find traces of STS principles and explore the viability of these principles on the design of IT systems.

Another venue for future work is to study whether the slow adoption of user centred approaches to design has an explanation in the political aspects involved when implementing IT systems. In general, implications for the use of user centred approaches in politicised contexts such as the ones studied in this thesis would be interesting to investigate.

A future closer to the topic of this thesis would be to further develop the concept of inertia in sociotechnical systems as a tool for analysing change efforts, but also to explore the viability of developing the concept into a tool to be used in collaboration with stakeholders in a change project: to identify sources of inertia as input for change management.
In the introduction to this thesis, the leading paragraph tells of the SUS-TAINS project being reported to a number of Swedish regulating authorities. However, the DOME project, the action research (AR) project within which our studies were performed, was also reported. In our case, we were reported on one account to the Central Ethical Review Board, responsible for the ethical vetting of Swedish research, and on four separate accounts to the Vice-Chancellor of Uppsala University. Thus far the DOME project has been cleared on all accounts, and quite thoroughly educated on the subject of ethical legislation and regulation in the process. Being under such scrutiny has most definitely had an impact on the researchers in the DOME project, and our way of interacting with each other and the subjects of our research. For this reason, a meta-research study on the use of AR as a methodology in such controversial projects would be interesting.
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In B. Czarniawska (Ed.), (pp. 1–13). Nordiska Företagsekonomiska Föreningens (NFF) konferens 2013, Reykjavik.


Abstract. Deployment of IT is little discussed in research literature, despite the fact that a successful deployment encompasses complexities and difficulties well worth investigating. The deployment phase of IT systems can be a make-or-break moment for usefulness of the system due to sociotechnical factors. We argue that there is a gap between the technological artefact produced and the social requirements that govern how well the system will fit in the organisation. Hence, in this work in progress paper we present a framework (the SOT framework) for analysing deployment of IT from a sociotechnical perspective.

Keywords: Sociotechnical systems, the SOT framework, Deployment, Implementation, Organisational change.

1 Introduction

Even though there is no lack of general studies in management and organisational science on the subject of organisational change (e.g. Wischnevsky and Damanpour [14] and Tsoukas and Chia [13]), and no lack of studies specifically grounded in an IT perspective on organisational change (e.g. Keen [6] and Markus [9]), we have found very few case studies on the planning and execution of IT systems deployment. Even though such research studies have proven hard to find, we argue that no matter the perceived usability of an IT system, sociotechnical factors make the deployment phase a make-or-break moment for many systems. We believe that there often is a discrepancy, a gap, between the technological artefact produced when an organisation decides to develop or procure a new IT system and the social requirements that govern how well this new system will fit in the organisation. In this context the social requirements denote the expectations, beliefs and wishes that the users may have in the widest sense. Examples of social requirements are people’s values and attitudes, the organisational culture, social norms and ethical frameworks as well as preferences
and expectations regarding usability and technical issues etc. This gap can turn the deployment phase of IT projects into something similar to forcing a square peg through a round hole.

Critical Success Factors are quite common phenomena within the research literature on how to successfully deploy information systems in organisations (see e.g. Cain and Mittman [3] and Leonard [7] for examples from health care). These factors are predominantly addressing social aspects of the deployment process. This is not surprising since the general view on systems development and deployment is that it is clearly divided into these two parts, where the former is concerned with creating a new technical artefact that satisfies a set of requirements and the latter is concerned with moving this artefact from its dry-dock of development into the organisation to test the system’s seaworthiness. But what is being tested here is not only the technological seaworthiness of the artefact; it is also the social and organisational seaworthiness of the artefact. From our perspective, sociotechnical change and the sociotechnical gap can be divided into three different aspects: the social, the technological, and the organisational. The technological aspect we believe warrants no further explanation, but as the social and the organisational aspects both stem from the social requirements concept presented earlier in this paper they are in need of some distinguishing traits: The social aspect is concerned with elements such as e.g. social norms, ethics, traditions, and workplace culture; whereas the organisational aspect concerns e.g. formal hierarchies, business processes, and policies. Using these three aspects and inspiration from Keen’s [6] concept of social inertia we would like to propose a framework consisting of social, technological and organisational inertia. In this context, inertia reflects the relative and varying ability of either of these aspects to adjust with respect to the other two. We believe that the sociotechnical gap presented here is a result of the collective inability of these aspects to reach a middle ground within an organisation. Regardless of what aspect is being inflexible, the result will be a corresponding increase in the sociotechnical gap and the suboptimal performance of the sociotechnical system.

This workshop paper will present work in progress regarding a framework (the SOT framework) that can be used to analyse the gap between social requirements, organisational matters and technology. The aim of this workshop paper is to generate a discussion regarding deployments in general, and the work in progress framework in particular.

2 Background

Abdelnour-Nocera et al. [1] illustrate how deploying a system in different social contexts renders different experiences of the system’s level of usability, and also how the interpretation of usefulness differs between users and developers. This is an example of the sociotechnical gap in practice, and through the authors’ use of technological frames a case is presented that further underlines the need for the fundamental understanding of social aspects stressed by Ackerman [2]. In their investigation, Abdelnour-Nocera et al. embarks from the assumption that “usefulness is not inherent in
a piece of software but is socially constructed in situ," which is directly compatible with the view on technical and social interdependence present within the concept of sociotechnical systems presented by Cooper and Foster [4]. Similarly, in their study of Alpha Corp., Orlikowski and Gash [10] exemplify how technological frames can be used within an organisation. The difference in assumptions, expectations, and knowledge identified within different parts of the organisation is a telling illustration of the complexities involved and how easy it is to inadvertently widen the sociotechnical gap.

A perspective on development of information systems in close relation to the deployment phase is the learning process perspective used by Hertzum et al. [5]. Through the use of pilot implementations the developers receive improved feedback that informs further development more efficiently than the use of prototypes or mock-ups, which are separated from a real work situation and thus harder for users to relate to. However, the use of pilot implementations is also a method for preparing the organisation for the coming change, and for the users (or at least a subset) to experience first hand how their daily work will change. As described by Ackerman [2], the increased interaction between users and developers will improve both the developers’ understanding of the users’ work to be supported by the information system, as well as the users’ understanding of what requirements the technology can satisfy. Though the use of pilot implementations will result in a costlier development process and is not always feasible for practical reasons (e.g. in some applications in health care, process control, and other situations where system reliability is critical), we believe that it is an underestimated approach in regards to both deployment and development benefits.

Using Suchman’s [12] metaphor of European and Trukese navigators, Orlikowski and Hofman [11] propose an improvisational model for change management. The point of the metaphor in relation to change management is that we think we need to plan rigorously and then relate our every action to that plan, like European navigators, but in reality we set out with a loosely defined objective and respond to changing conditions in an ad hoc fashion, like the Trukese. The authors argue that perhaps traditional technological change models, based on the works of Lewin [8], are insufficient to handle the organisational and environmental conditions of the present. Instead, they propose a change management model that embraces the Trukese way of handling uncertainty, regarding “change management more as an ongoing improvisation than a staged event”[11]. We agree with their view on traditional technological change models as outdated, and believe that one of the keys to successful change management is to adapt to the fact that there will always be unknowns, no matter how much you plan, and to always plan for uncertainty.

The improvisational model described by Orlikowski and Hofman [11] is mainly suitable for innovations, where the technological development is still rapidly progressing, open to new feedback, and adapting to user requests. However, when regarding well-established technology, or “black box” technology (designed to work without the need for adaptations), the authors concede that this approach might not be suitable. Although we agree with the authors, we believe that the level of flexibility championed by the improvisational model needs to be adopted for this kind of technological
change as well. As flexibility and managing uncertainty is an integral part of technological change also in rigid, bureaucratic organisations, models must be found that can handle this paradox.

3 The SOT framework

A goal of the SOT framework is to balance on the fine edge where it is simple enough to be communicated and understood easily by researchers and practitioners while also being powerful enough to be useful. One step towards this is the visualization of the framework illustrated by figure 1 below.

![The SOT framework](image)

**Figure 1. The SOT framework**

The figure illustrates how the sociotechnical gap is located in the middle of the social (S), organisational (O) and technical (T) aspects we associate with organisational change. In this context we propose the concept of inertia to reflect the relative and varying ability of either of these aspects to adjust with respect to the other two. We believe that the sociotechnical gap is a result of the collective inability of these as-
pects to reach a middle ground within an organisation. Regardless of what aspect is being inflexible, the result will be a corresponding increase in the sociotechnical gap and the suboptimal performance of the sociotechnical system. After further expanding on this framework we believe that it can be used within change management projects to improve the process of planning and executing organisational change, and by researchers to study and analyse organisational change processes.

4 Conclusions

The SOT framework has the potential to become a useful tool to analyse deployments of IT systems. However, the framework needs further development in several regards. First and foremost we need to better relate the framework to sociotechnical theory and also to related theories such as diffusion of innovation and the technology acceptance model.

5 Acknowledgements

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6 References


Evaluation of user adoption during three module deployments of region-wide electronic patient record systems

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ABSTRACT

Background: In Sweden there are modular region-wide EPR systems that are implemented at various health organisations in the region. The market is dominated by four IT systems that have been procured and deployed in 18 out of 21 regions.

Methods: In a 2.5-year research study, deployments of three region-wide EPR modules: a patient administration system, eReferral module and eMedication module were followed and evaluated. Health professionals, EPR maintenance organisation, IT and health care managers were observed, interviewed and responded to questionnaires.

Results: Although the same deployment process was used during the three deployments, large variations in the units’ adoptions were observed. The variations were due to: (1) expectation and attitude, (2) management and steering, (3) end-user involvement, (4) EPR learning, and (5) usability and the possibility of changing and improving the EPR.

Conclusions: If changes in work processes are not considered in development and deployment, the potential benefits will not be achieved. It is therefore crucial that EPR deployment is conceived as organisational development. Users must be supported not just before and during the go-live phase, but also in the post-period. A problem often encountered is that it is difficult to make late changes in a region-wide EPR, and it is an open question whether it is possible to talk about a successful deployment if the usability of the introduced system is low.

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1. Introduction

In Sweden, responsibility for health and medical care is shared between three independent governmental levels: the national governmental level, 21 self-governed county councils/regions and the 290 municipalities. These bodies can either choose to deliver the care themselves or use private companies, cooperatives or non-profit organisations. For decades Sweden has been one of the leading eHealth countries in the world [1] and over the last ten years eHealth development has moved towards using region-wide electronic patient record (EPR) systems. Region-wide EPR means that the system is shared between all care providers (i.e., primary and hospital...
care) within the same county council/region. The market is dominated by four IT systems that have been procured and deployed in 18 out of 21 counties. The four¹ vendors are: Cambio healthcare systems (Cambio Cosmic), Compugroup (Takecare), Evry (Evry Cross) and Norrbotten’s county council (VAS). Even though the same vendor supports several county councils, they each have their own instances, terminology and configurations [2]. All systems are module based and provide clinical care support and patient administration functionalities. This means that in 18 county councils the patient information (notes made by all care providers within the same county council) is stored in the same EPR. The county councils’ motivations for using region-wide EPR are: (1) increased accessibility – all patient information within the county council should be accessible for all care providers within the same county council, (2) same structure – easier to share and access information, (3) cost reductions – less double documentation, re-use test results etc., and (4) better informed health professionals – fewer unnecessary meetings with patients. Although the county councils share a region-wide EPR system, they still have more than 30 other IT systems (i.e., radiology, laboratory and ordering supplies) to support their needs. Some of the IT systems can be accessed from the EPR, while others require another login. In order to make sharing of information possible between the county councils and municipalities, a national “patient overview”-system has been developed but not yet fully implemented throughout the county councils/regions and municipalities.

This paper is based on a 2.5-year research project of one of the county councils and the university. The participating county councils are responsible for the care of more than 300,000 citizens. They have 13,000 employees distributed across a university hospital, a smaller hospital and 40 primary care centres. They are using one of the mentioned region-wide EPR system to share information within and between the different units/organisations. During the research project the deployment of three region-wide EPR modules were evaluated and different stakeholders were interviewed and observed. Analyses in our previous studies, performed in the same county council [3–5], show that the health professionals (i.e., nurses, physicians, assistant nurses and paramedics) considered the region-wide EPR system to increase accessibility and readability. Accessibility means that every patient has one electronic record that is immediately accessible for all care providers in the same region. Readability means that with the region-wide EPR system the health professionals no longer need to search for missing paper records, and the computer-based records are always easy to read. Despite the benefits experienced, all participants agreed that the region-wide EPR did not provide sufficient support, and they argued that the system had low usability and was time-consuming to use. The health professionals, both nurses and physicians, considered the EPR system to have major usability problems and to be non-intuitive, and most users experienced that using the system had increased their computer time and decreased their patient time [5]. The user adoption problems had slowed down the deployment process; however, the managers were convinced that, if the health professionals followed the processes the system was built on, many of the usability problems would disappear [6]. Previous studies [3–5] discuss how physicians and nurses experiences deploying and using EPR [4,5] and how time, usage and context effected the PAS deployment [3].

The aim of this paper is to identify areas that can be, depending on how they are managed, perceived as barriers and/or success factors for user adoption while deploying and using a region-wide EPR system. The paper is based on a cross-analysis of evaluations of three region-wide EPR module deployments within the same Swedish county council.

1.1. Region-wide EPR vs. enterprise-wide IT

Region-wide EPR systems that are developed by vendor and shared between several health organisations have many similarities with traditional enterprise-wide (EW) IT systems [7]. According to Davenport, EW systems are commercial software (often module based) that promises a seamless integration of all information flowing through the organisation [8]. Markus and Tanis have a similar definition that EW systems are “commercial software packages that enable the integration of transactions-oriented data and business processes throughout an organisation” [9] (p. 176). The EW system is a generic solution that is built to solve the fragmentation of information in organisations. The systems are based on the vendor’s assumptions of best practice. Defining best practice is contentious; e.g., clinical best practice and IT best practice may not align well [8]. In theory, enterprise systems are great. The benefit of having all information seamlessly integrated makes it easier to access and share information within the organisation. In real-life EW systems however, research has shown that there is a high failure rate on deployment of EW systems [8–10]. In order to succeed with EW systems, it is crucial to have clear goals about what the systems should support. Reworking the organisation’s processes is necessary in order to achieve an ideal match between the system and the context. Usually some degree of customisation is possible. Customisation of the software can, however, be expensive and often a hindrance to achievement of the aim of information seamlessly flowing through the organisation [8]. Despite the benefits, a common argument for not selecting EW solutions is that the processes on which the IT system is based (often called best practice, according to the vendors) do not represent the processes used in the organisations. So, the users need to change their processes in order to work effectively with the system [10].

1.2. Deployments and user adoption

The aim of our study was to investigate the process in which the IT system is deployed. This means that we have not studied the technical implementation; instead we were interested in the process in which the IT system is introduced and adopted by the organisation and users. To emphasise our focus, we chose to use the term deployment instead of implementation. In previous research both deployment and

¹ There is a fifth: Siemens (Melior), which has a large market share. However, because Melior is used in hospitals and not shared between primary care and hospital care, it has not been included as a region-wide EPR.
implementation are used for the process that we refer to as the deployment. However, we feel that a separation between the terms is necessary to emphasise that it is not just the technical parts that are important: organisational and behavioural aspects are equally important as technology to achieve an effective and efficient health IT adoption [11–13].

With deployment we refer to the process when the system is introduced and adopted by the organisation and users, while with implementation we refer to the technical installations etc. For decades research about health IT has shown that it is difficult to succeed with deployment of health IT [11–24]. Many researchers have identified critical success factors (CSF) for succeeding with health IT and EW deployments [25,26]. According to Poon and Wagner [27], CSFs are “the conditions that need to be met to assure success of the system” (p. 395). They are often presented as shortcuts to a successful deployment and usage. Research on CSFs has been criticised as being deterministic and excluding situational and contextual factors [7,28].

Pinelle and Gutwin [29] argue that one of the greatest challenges to health IT deployments is the structure of the health care organisation. Western health care organisations are often diverse with specialised divisions and units, with different administrative and management organisations only loosely coupled together. The different units have high autonomy and are specialised in different areas of the care delivery. Pinelle and Gutwin [29] argue that the structure of the organisation is both a driver and a barrier. The structure of loosely coupled units increases the need for IT that supports sharing information and collaboration. The complex organisational structure makes it hard to deploy new technology successfully. The problems become noticeable when the organisation aims to deploy the same region-wide IT, and the different units, with their tradition of high autonomy, have a different idea about how the work should be carried out. The authors [29] suggest five strategies for introducing health IT systems into loosely coupled health care settings.

- Use focus groups to bring representatives from different units to the table to confront differences and build consensus
- Use bottom-up deployment strategy, direct deployment efforts from the operational unit and not from administrative units or management
- Identify local champions in the operational units who can help build consensus among colleagues
- Align roles and responsibilities to minimise role conflicts
- Address inequity early, employ user-centred design and involve users in the deployment planning session [29] (pp. 562–566).

The five strategies emphasise the importance of including and engaging the end-users in the deployment activities. Previous research shows that it is not just important to involve the end-users in the deployment activities they should be involved throughout the whole development process [30]. The importance of end-users participation in health IT development has been studied by [31]. The authors come to the conclusion that the power balance between the stakeholders (IT organisation, clinical organisation, management and vendor) has a major affect on if the end-users (health professionals) become real participants with the power to change and improve or just being clinical consultants. Real end-user participation is essential for the successful outcome of HIT development. Kanstrup [32] is emphasising the importance of not just having local IT supports that are involved; it is crucial to have participatory IT supports. The authors are providing a method for identifying qualified candidates for the support position.

1.3. Sociotechnical theories to explain deployment outcome

Using theories about sociotechnical systems to explain deployment outcome and user adoption has become more and more common in the last decade [11,12,21,22,33–38]. A sociotechnical approach means that explanations of the deployment outcome and user adoption have organisational, technological and behavioural explanations. According to Lorenzi and Riley [21,22], the reasons for a system failure have different characters: communication, culture, an underestimation of complexity, scope creep, organisational, technological, training and leadership issues (p. 118). Berg [12] argues that a successful IT deployment is socially negotiated. For example, what is considered to be a successful deployment for health professionals might not be the same for the hospital management or the IT manager and vice versa. These issues are often not realised within the organisations, and Berg argues that to begin a discussion about what a successful deployment process is will open the eyes of the organisation to the complex meaning of success and failure. This discrepancy could be explained by the fact that they measure success differently [12]. For some stakeholders economic aspects are the most important measurement, and for others the usage is the most important. The success or the failure of the deployment can also change over time; for example the deployment can be considered to be a success by the users in the beginning, and then after a few months the users feel that the system is not supporting them and at that time consider it to be a failure. Berg [12] argues that, even if one can come up with a measurement for the success of an IT deployment it is impossible to use the same perspective in another context concerning another organisation. Organisations have different contexts, sizes and forms of leadership that affect how they react to the same IT system and the same deployment strategy. In our study, we adopt the health professionals’ perspective when we are analysing the EPR deployment and user adoption. Maria Lluch [37] conducted a literature review about previous research (31 sources between 1995 and 2009 in total) about health care professionals’ organisational barriers to health IT. The focus was on sociotechnical aspects of health IT implementation or post-implementation in health care settings. Lluch used Galbraith’s star model to identify five categories of barriers among the research. The barriers are: (1) structure of health care organisations, (2) tasks, (3) people policies, (4) incentives, and (5) information and decision processes. Even though Lluch sorted the barriers into five categories, she emphasises that they are not stand-alone categories. Instead, they are all interrelated with each other. In our research study, the five categories mentioned can be observed, but we argue that they can be seen
as barriers and/or reasons for success. In our study, two factors that are not mentioned in Luch’s literature review have been added: usability and the possibility of changing and improving the IT system. Usability aspects are often mentioned in health IT research, but in combination with a sociotechnical approach for analysing eHealth deployments and usage, they are often ignored, except in a few examples [11,12,39].

1.4. The studied deployment process

The evaluated deployments followed the same deployment process. The deployment process was both centrally and locally managed. The central deployment group consisted of a project leader, a number of people from the EPR maintenance organisation and one EPR coordinator from each division (the group consisted of up to 15 individuals). The central deployment group was responsible for: (i) centrally steering the deployments, (ii) informing the EPR coordinators about strategies and new work processes, and (iii) creating a forum in which the EPR coordinators received support and guidance during the deployments. The central deployment group was responsible for central steering of the deployments. They had regular meetings before and during the deployment. In those meetings the EPR coordinators discussed progress, and the EPR maintenance organisation spread information about shared strategies and clinical routines.

Most EPR coordinators were educated health professionals that worked fulltime with EPR-related issues. Their responsibilities were to manage the deployments and support the units in their everyday EPR usage. The clinical divisions selected the EPR coordinators and their role was to be the link between the IT organisation and the end-users. Their responsibility during the deployments was to locally manage and steer the divisions’ deployment process. The EPR coordinators were in charge of a group of super-users who represented each of the division’s units. Together they were responsible for identifying existing and new work processes, and teaching the health professionals to use the IT system according to the new work processes.

2. Methods

In this paper, deployments of three region-wide EPR system modules are evaluated. The aim is to identify areas that can, depending on how they are managed, be perceived as barriers and/or success factors for user adoption while deploying a region-wide EPR system. The three module deployments evaluated are PAS, eReferral and eMedication. All three modules are, together with care documentation, cornerstones in a region-wide EPR system. The evaluations were part of a 2.5-year research project of the county council and the university. The aim of the project was to find methods and processes that would help the organisations to work more effectively with their core IT systems. During the studies, both qualitative and quantitative methods were used (see Table 1).

During the data gathering, the focus was on different aspects of user adoption:

- User participation: do the users participate in deployment activities? If yes: what kind of activities do they participate in? If no: what hinders the users to participate?
- Learn to use the IT system: where did the users learn to use the system? How did they experience the activities that were organised by the central deployment group and the super-users?
- Prepare for new work routines: how did the main stakeholder groups work with preparing new work routines and changed management?
- Support for the users: what kind of support did the users get during the deployment? Who provided the support? How did the users experience the support?

After and during the evaluations, the findings were discussed in different seminars and workshops at the health care organisation. The aim of those meetings was to discuss the evaluation with them in order to improve their deployment process. We give a more thorough description of the activities during the three deployments below.

2.1. From old PAS system to PAS module

The patient administration system (PAS) deployment was studied in three university hospital units, an infection disease ward, a gynaecology ward and an orthopaedic open care unit. Both quantitative and qualitative methods were used before and during the go-live and up to two years after the deployment. To measure usability, a validated questionnaire called Avl (abbreviation for Användbarhetsindex in Swedish) was used. The goal with Avl was to describe the processes behind usability. The questionnaire contained 16 questions that were divided into six subscales: (1) system development, (2) usage, (3) utility, (4) competence, (5) stress and health and (6) relations [40]. The first questionnaire concerned the old PAS system and was distributed before the deployment of the new system. The second questionnaire was distributed after two months of usage and the third after ten months of usage. To complement the questionnaires, interviews and observations were performed during the three measurement points and during the go-live. In the open care unit, they receive many new patients every day, a fact that meant that nurses and assistants used the PAS functionalities for several hours a day. In the wards, the PAS functionalities were just used when a new patient arrived or when a patient was discharged. In both wards, the old PAS was just used by the clerks, a situation which meant that most staff rarely used it. Deploying the new PAS affected the staff in the three wards differently. For the staff in the open care unit, it meant that they were going to perform the same tasks in a new system, while in the wards using the new PAS meant changes in practice. The new tasks required that the PAS tasks be distributed among all staff instead of being just the clerks’ responsibility. More detailed information about the PAS deployment can be found in [3].

2.2. From paper-based referrals to eReferral

The benefits with the eReferral module were that all referrals were electronic instead of on paper. This practice meant faster
replies, a more secure process and easier traceability of referrals and answers. Before our evaluation, the eReferral module had already been deployed and used in the primary care centres. This meant that the primary care centres ordered the referrals in the EPR, but sent a printed version to the specialists at the hospital. During the eReferral deployment, the central deployment group’s activities and the primary care centres’ preparations were evaluated. During the evaluation, we participated as observers during the central deployment group’s meetings and when the super-users and EPR coordinators learned to use the eReferral system. In addition to these occasions, managers from six primary care centres were asked to participate in a short telephone interview about how they prepared their organisation for the new process of ordering and receiving referrals electronically instead of on paper. Users in two primary care centres were also observed and interviewed while they used the eReferral system.

2.3. From paper-based drug lists to eMedication

The deployment of the eMedication module was evaluated in two hospital wards, a medical ward and a surgical ward. The deployment at the hospital was a part of the county council’s larger “big bang” deployment. All hospital units and wards, with a few exceptions, were going to adopt the eMedication module. The eMedication module had been deployed in a few wards at the university hospital. Some of the wards considered it to be an effective tool while others had interrupted the deployment and gone back to the old routines. During the evaluation, both qualitative and quantitative methods were used. The quantitative method was a questionnaire that was sent to all end-users between the learning sessions and go-live. This questionnaire had the same structure as the questionnaire conducted during the PAS deployment [40]. Before, during and after the go-live, nurses and physicians in the two wards were observed and interviewed. The observations in the wards were conducted during clinical rounds, when the level of medication-related work activities was highest. We also participated as observers during the central and local deployment group’s activities, when super-users were introduced to the eMedication module and during the end-users’ learning sessions.

2.4. The cross-case analyses

In this paper, we performed a cross-case analysis of the three evaluations. The analyses were divided into four steps: (1) the written reports from each of the three evaluations were reviewed; (2) the empirical data (e.g., interview transcripts, notes and questionnaire results) from the three evaluations were reviewed; (3) the data from the first and second steps were condensed to main categories for barriers and reasons for a successful user adoption; and (4) the identified categories were compared with previous research about implementation/deployment and user adoption of eHealth. The five categories are:

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<th>Table 1 – Information about the three deployments. Where the evaluation took place, what data methods that were used and who the end-users were.</th>
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<tr>
<td><strong>About the module and the deployment</strong></td>
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<tr>
<td><strong>Where did the evaluations take place?</strong></td>
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<td><strong>The end-users</strong></td>
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The results are presented according to our five analysis categories: (1) expectation, attitude and outcome, (2) management and steering, (3) end-user involvement, (4) EPR learning, and (5) usability and the possibility of changing and improving the IT system. The categories are grounded in our research findings, and the first four are common in sociotechnical research [37]. The reasons for adding usability and possibility of improving the system was that the analyses showed that even though the organisation succeed with the first four categories, it was not certain that user adoption would be increased [3]. In summary, the region-wide EPR systems’ possibility of adapting to and improve the users’ processes is crucial for user adoption. In the next part of this chapter, we provide the reader with empirical examples of when the five categories had been ignored and acted as barriers to user adoption and when they had been considered and had acted as reasons for a successful user adoption.

3.1. Expectations, attitude and outcome

During the evaluations we could see that the expectations and attitudes of the health professionals, as well as those of the clinical managers, the EPR maintenance organisation and the super-users, had a significant impact on user adoption. The analysis of the evaluations illustrates that this factor could be a barrier when stakeholders representing the IT organisation and stakeholders representing the clinical organisation had different expectations of the impact the EPR would have on the users’ practice.

3.1.1. Managers’ expectations vs. users’ adaption

Using the eReferrals would lead to a continuous electronic flow between the hospitals and primary care centres. The managers and central deployment group’s expectations were a bit naïve, and that they had forgotten to consider how using the eReferral would affect the physicians’ work. Before, while using paper referrals, the clerks sorted them and handed them out to the physicians. The physicians could go and search for a paper folder. If the folder was there, they had some new referrals. When they used eReferrals, incoming referrals were not visible in the same way. Some physicians thought that this working routine, to always check the inbox, was harder to manage. They also found that if they were sick or on holidays, no one knew how many unanswered referrals they had in their inbox. Some of the units handled this uncertainty by printing the eReferrals and putting them in a paper folder, to remind the physicians that they had something in their inbox. This policy caused extra routines for the clerks. In conclusion, the managements’ expectation that the physicians would overcome the new workload is not easy to predict; instead, the physicians need to be prepared for unexpected consequences.

3.1.2. End-users expectations and attitudes

During the eMedication deployment, the health professionals’ expectations varied between hope and fear. The fears came out of rumours from colleagues who worked at wards that already had deployed eMedication. A remarkable number of users had not, however, reflected on the module or its expected impact at all. During the interviews the health professionals mentioned two reasons for adoption eMedication, improved readability and patient security. This position was probably heavily influenced by the fact that these two factors were presented, by the EPR management and hospital management, as key reasons for deploying the eMedication system. The fear was regarding shortcomings in the system’s usability and the lack of feedback when sending bug reports/requests for improvements. Despite these issues, they were in general hopeful and believed that with time the medication management process would be improved by eMedication. The health professionals were also aware that it would take time before using eMedication became more efficient than their old routines. This awareness stemmed from earlier EPR deployment experiences in which the health professionals described the work situation as being somewhat chaotic from time to time before they had adjusted to the new routines. In interviews with physicians and nurses one month after the go-live, only a few felt that their expectations had been met, and the majority believed that the module performed below their expectations, and none that it exceeded their expectations. Despite their expectations not being met in general, the health professionals still believed, however, that working with the module would become easier and more efficient with time. In this example, we can see that letting the health professionals’ discuss and express their expectations and attitude and increase their awareness that it takes time before system usage stabilises affects their attitude and the outcome. Attitude, however, is not everything; to meet the health professionals’ expectations, it is crucial to continue work on improving the clinical routines and the systems functionalities. If that is not done, the expectations will fade and will be replaced by frustration and irritation.
3.2. Management and steering

All evaluated deployments were coordinated according to the same deployment model. This meant that the activities were both centrally and locally managed. All clinical divisions had selected one EPR coordinator, and the units had selected their own super-user. In the analyses, we could see that both the hospital managers’ and clinical managers’ attitude towards the system and deployment process had a great impact on the user adoption.

3.2.1. Delegating responsibility

During the PAS deployment, the managers delegated the responsibility for the deployment process to super-users. The interviews showed that they all trusted the super-users, but they had different perceptions regarding how involved they, as managers, needed to be. The manager of the open care unit realised the importance of getting a great introduction to the system and gave the super-user a few month off her ordinary duties to prepare and support deployment activities. She also realised the importance for her, as a manager, to know the new tool and supported the super-user by participating in the unit’s learning session. Doing so showed the other staff that she considered the PAS to be crucial. In the wards the managers argued that they had delegated the responsibility to the super-users, which meant that they trusted that the super-user would manage the deployment or ask for help and support if needed. The managers in the wards did not participate in the learning sessions. Their reasons were lack of time and that they were not going to be users of the system. Our analyses show that the staff in the open care unit trusted the super-user and understood the importance of learning the new PAS, while in the wards both staff and managers did not consider the PAS system to be important. Consequently, after the staff in the open care unit used the system as planned, the staff in the wards did not use the system according to the plan, but instead the ward clerks continued to use the system as before.

3.2.2. Listen to the users

Despite the fact that the term “referral” had long-since been defined, it was used in various ways in practice. Before the eReferrals were implemented, the hospital management saw a need to investigate all the different ways the terms were used in practice. In this process, the hospital management asked the super-users to map all ways the term referral was used. The final report indicated what they expected. Even though the clinical directors saw the different interpretations, they decided to stick with a definition that was quite similar to the previous definition. This decision made the health professionals frustrated and they felt that they were asked to engage, but, ultimately, not to be heard. According to the health professionals, they found the regulations too limited, but when paper referrals were used it was possible to create customised forms and circumvent the rules. If an IT system is configured around the regulations, however, it is nearly impossible to ignore the regulations. “Great”, most would say, but we, on the other hand, argue that it would have been better if the clinical directors had investigated the reasons regulations were not followed instead of ignoring this fact. This example shows that, if you ask the health professionals for advice, it is of utmost importance that you ask the right questions and that you listen to their responses; if not, their frustrations will increase.

3.3. End-user involvement

End-user involvement is crucial, because it is the process in which the users start to feel that it is their new tool, not an IT system that they are forced to use. During the studies, we could see that it was especially hard to get physicians to participate. The health professionals gave a few reasons they did not participate: (1) they were not asked, (2) some of those that had participated in previous IT related activities said that they did not feel that they had the opportunity to change and improve what they needed, and (3) the physicians, in particular, found it hard to allocate time to participate.

3.3.1. Difficult to motivate physicians

During the eMedication deployment, the overall end-user involvement was limited to mandatory learning sessions in which the super-users educated the physicians and nurses about how to work with eMedication. A few physicians and nurses from the medication and the surgery units were also asked to engage in creating medication templates and to update work instructions. The study shows differences between the medication units and surgical units regarding how well the templates were prepared and distributed. The physicians and nurses in the medicine unit were more thorough, while the physicians who worked in the surgical units were harder to motivate. This discrepancy could be explained, because managing medications is a greater part of the medicine units than the surgical units. It could also be explained by the managers in the medicine unit allocating more time for the nurses and physicians to participate than the clinical managers in the surgical unit did.

3.3.2. Easier to motivate nurses

During the PAS deployment, most of the nurses and assistant nurses that worked in the open care unit felt involved and engaged. Before the go-live, the staff was asked to manually transfer the data from the old system to the new system. Even though it was voluntary, most staff worked extra hours during several evenings to transfer the information. To ensure the quality during the process, they worked in pairs. All staff and the manager found this process very stressful and time-consuming, but they also saw it as good exercise for working with the new system. In the studies, we can see that it was easier to motivate nurses than physicians to participate.

3.4. EPR learning

During the deployments, all end-users had the opportunity to participate in learning sessions. These sessions were held by the super-users who themselves had attended a system introduction for up to three days. The central deployment group wanted the learning sessions to be mandatory for all end-users, but they did not have mandate to require that. Instead, it was the clinical managers’ responsibility to make sure that the end-users participated in the learning sessions. Almost all
nurses and physicians participated, but there were never any serious consequences if they did not participate.

3.4.1. Time for individual practice
During the learning sessions, all end-users had access to individual computers, and the super-users started by showing how to navigate and perform different tasks. After that, the participants had time to practice the tasks with fictive patients. To help the health professionals, the super-users had prepared step-by-step templates and materials so the professionals could practice by themselves before the go-live. During the PAS deployment, the health professionals thought that it was great to have the opportunity to participate in learning sessions, but the results from the questionnaire shows that 90% of the respondents only practiced once or did not practice at all before the go-live. The respondents gave different reasons. Some said they sufficiently experienced the learning sessions; other reasons were that they did not know that they could practice or that they did not have time to practice. Our experience from the learning sessions was that they were organised around a theoretical approach to viewing the clinical process. When we asked the super-users about this approach, they said that they had found it hard to customise the educations towards the users' needs, because this required that the system could be customised towards the units' individual needs. We saw a need for organising the learning sessions around actual usage, and, if the users had practiced on their own before the go-live, they would have experienced some of the problems earlier, a circumstance which would have affected the adoption after the go-live.

3.4.2. Need for allocated time
The learning sessions were usually held by the super-users (nurses or clerks), but during the eMedication deployment the central deployment group advised the clinical organisation to select both nurses and physicians as super-users. The reason for this advice was that previous experiences indicated that, despite the nurses or clerks' competence, it was hard for nurses to gain respect among the physicians. The idea was that nurses organised and prepared learning sessions for the nurses, while physicians organised learning sessions for the physicians. Due to differences in the amount of time allocated for the duties, the nurses had more time to prepare these sessions and conducted them with more confidence compared to that of the physicians. The physicians seemed to be required to spend time on the deployment activities without having any time freed from their regular activities. For the nurses, time was allocated to spend on the project, but, depending on the unit they came from, the amount of time varied significantly. This anecdotal datum illustrates that, if the IT system is considered to be a critical tool for health professionals, it is crucial that both physicians and nurses be allocated time for learning and participating in the preparations.

3.5. Usability and the possibility of changing and improving IT

Previous literature about EW deployments conclude that to succeed with deploying a region-wide IT system, it is crucial that the users rework their routines and are willing to change practice according to the system's design and functionalities [8–10]. Our interviews and observations show that the users try to adapt practices. Shortcomings in design and usability issues, however, have a significant effect on their adoption. This fact means that in order to increase user adoption, it is not enough to rework practice; it is also essential for the users to have the possibility of improving the systems functionalities according to their needs.

3.5.1. Gathering ideas for improvements
While learning the PAS, the health professionals started to experience shortcomings in the new system. Many of the users had great ideas on how the shortcomings could be solved, so they decided to gather all problems and ideas for improvements. The ideas were distributed to the EPR maintenance organisation, and after the go-live they added more suggestions to the list. Most of the suggestions were about getting a better overview, simpler navigation and fewer steps to perform tasks. Most of the health professionals were particularly worried and disturbed by the fact that the system lacked a good overview and thought that their suggestions for improvements would make their work easier and safer. The users were happy about their work, an impression that quickly faded, however, because they received the response that most of their suggestions were up to the vendor to solve and not something they could solve by locally configuring the system. After two years of PAS usage, we went back to the open care unit and asked about how they had experienced the system. We were devastated to hear that none of their suggestions had been implemented, and that the users still felt uncertain about how to perform some tasks. During those years, the super-users had prepared step-by-step templates and organised several learning sessions, but the usage had not improved because of the shortcomings of the system.

3.5.2. Impossible to change
The users found the region-wide system hard to change and improve. During the learning session, one surgeon mentioned that he had participated in a working group regarding improvements of the eFerral system a year earlier. He said that he had not received any feedback on whether they had made any improvements according to his suggestions. One representative from the central deployment group responded by saying, “We have the module we have; you can make suggestions but we cannot do anything to meet them". She continued by saying that the vendor had prepared a new release that would be deployed approximately six months after the central deployment. After six months of usage, however, the problems still existed, and the new release had not yet been launched.

4. Discussion
In the result section, we have presented results from three evaluations of user adoption during three EPR modules' deployments. Different stakeholder groups from different units participated in the evaluations in order to obtain a more comprehensive analysis. During the deployments, we could see that, even though the same deployment model was used,
some units considered the deployment to be successful and the system supportive, while others thought that using the system presented a risk of major safety problems. During the analysis, five categories: (1) expectation, attitude and outcome, (2) management and steering, (3) end-user involvement, (4) EPR learning, and (5) usability and the possibility of changing and improving the IT system were identified as barriers and/or reasons for successful user adoption when deploying a region-wide EPR system. The categories are labelled as both barriers to and reasons for success because the analysis shows that the way the units work with these issues have both negative and positive effects on the user adoption. Even though the categories are presented as separate categories, the examples illustrate that they are not isolated. Instead, they affect each other.

4.1. IT deployment conceived as organisational development

The citations in the result section above all indicate that the headings mentioned are hard to separate, and, even though the open care unit succeeded with all, except number (5) during the PAS, the users did not receive the expected benefits from the system. The analyses indicate that IT deployment must be conceived as organisational development. Today, the IT organisation considers the region-wide EPR as the clinical organisation’s tool, intended to improve quality of care, while the clinical organisation considers it to be an IT system that is static and impossible to improve and that it affects the clinical practice in an unintended and sometimes unwanted way [38,41,42]. Many of the physicians considered that after the deployments they received new work tasks to carry out, tasks that previously had been managed by other health professionals, and now were their own responsibility to manage. These responsibilities could be both care and administrative routines. When the health professionals label them as administrative tasks, they often consider it to be extra, unwanted work [5]. If the health care organisation considers deploying an EPR system as their tool and a part of the organisational development, this deployment will imply that the IT system is strategically intended to affect the organisation. Today the health professionals are not considering the region-wide EPR system to be a tool to improve clinical practice and quality of care, but as an IT tool that one must learn to use. During the research studies, we developed a strategy about how the organisation should work in order to integrate the IT deployment as a part of the on-going organisational development. Central to the strategy is that region-wide EPR needs to be seen as a tool in the continuous development of care processes. Some recommendations that can improve the situation are:

• The new work processes must be developed prior to the deployment. This procedure must be done in a user-centred way, with high local engagement.
• Make sure that the IT systems that are deployed are usability tested before the deployment starts.
• All user groups must be supported with customised education and training programmes, since they have different positions, responsibilities, experiences and needs.
• Base education and training on relevant work scenarios. It is important to learn not only how to use the new system, but also how to efficiently perform the new work processes, using the new system.
• Let user representatives be actively involved in the education and training of their colleagues.
• Give the local care units a mandate to plan and perform the training programmes according to their own needs and expectations.

Our recommendations share with Pinelle and Gutwin [29] the importance of having a locally planned deployment. The main difference is that we also emphasise the importance of usability testing the system and improving the shortcomings instead of trusting that shortcomings in usability can be compensated for by more education sessions.

4.2. Can a system with low usability have a successful deployment?

In our research studies, we can see that some of the deployments have been more successful than others. A deployment can be considered as successful for different reasons [12]. In our studies, we focused on the user adoption. In other words, if we have a successful deployment process in the sense that it is conducted according to best practice, but the deployed system has a low level of usability, the result for the end-users will ultimately be negative: “The operation was successful, but the patient died”. We mean that both things must and should be obtained, i.e., both a useful product and a successful deployment.

Given that the system to be deployed has certain usability problems but will be deployed nevertheless, some of the usability problems can be reduced if the deployment process is successful in itself. Skilled professionals are often very good at overcoming usability obstacles if they are given the proper resources, education and training. But to work continuously with a system with usability problems can never be recommended. It will result in low efficiency, safety problems, irritation, stress and a bad work environment [3].

One common argument against EWS systems is that the processes that the system is based on do not represent those used in the organisation. Consequently, the users need to change their processes in order to work effectively with the system. To obtain optimal benefit of an EWS system, without large extra efforts and costs, one is supposed to keep the system as it is and tailor the organisation and work processes [30]. In our research, we can see that the limited opportunity for changing the system and improving its usability is a major reason for the poor adoption in the health care region studied [3–6,43].

4.3. Problems regarding the deployment model

All deployments were centrally managed, but EPR coordinators and local super-users were selected to adapt the process to the local units’ needs. The aim of this set up was that the deployment should be locally anchored. Those who specify the new work routines and teach the health professionals should be aware of local routines and have the opportunity to plan new routines that are customised to the local clinical
unit’s needs. One problem that we could see during the deployments was that the local project groups found it hard to identify new work processes and customise the learning sessions to these processes. Thus the end-users learning sessions were performed in the same way in the different units. They often focused on how to navigate in the system and not so much on the new clinical work processes and routines. The users interviewed said that they expected that the super-users should teach them how to navigate and not how to use the system because they thought that it was hard to learn how to practically use the system in a training environment. Before the go-live, most health professionals felt well prepared, but after the go-live, they said that they were unprepared for how to effectively use the system in their daily practice. Because of this feeling, we argue that it is crucial to base education and training on relevant work scenarios.

4.4. Possibilities to improve the system

Theoretically, customising the IT system can make improvements regarding how the system works in the clinical settings and/or by changing clinical work routines so they align with the design of the IT system. We have chosen to look at the EPR system as an EW system because it takes years before design or functionality can be changed, and lack of opportunities to improve the system’s functionality came up as a barrier to user adoption. Today the studied organisations can improve the region-wide EPR system and usage in these ways:

- They can customise templates and key words within the system. Those settings are sometimes standardised for the whole organisation and sometimes for the different clinical units’ needs. The decisions about the possibilities to customise are made by the top management for the different health care organisations.
- Together with the other county councils that are also customers of the vendor, they can agree on what improvements are needed and what new functionalities are wanted. This process takes time.
- They should plan new work processes and routines to fit the system’s design.

5. Conclusion

The results in this paper provide both research and practice with valuable findings. The contribution for research is a slightly different perspective. Instead of focusing on identifying critical success factors or barriers for user adoption, like most previous research has done, this paper focuses on identifying areas that can be seen as either barriers to and/or success factors for user adoption, while implementing a Region-wide EPR system. The user adoption depends on how the areas are managed during the deployment process. The five areas that were identified are: (1) expectation attitude and outcome, (2) management and steering, (3) end-user involvement, (4) EPR learning, and (5) usability and the possibility of changing and improving the IT system. Area (1)–(4) can be seen in previous research about sociotechnical systems, user adoption and eHealth deployments, meanwhile area (5) usability aspects and the possibility to improve the IT system, is rarely included as important aspects. In the result section the authors are presenting empirically based examples that illustrate how the five areas are working as success factors or barriers. The mentioned areas are all affecting each other and cannot be isolated and separated. All five areas are crucial and if one is not met the others will be affected.

The papers contribution to practice is by providing recommendations for how to increase user adoption while deploying EW IT systems. The analysis illustrates that the first four areas can be managed by improvements within the health care organisations, meanwhile the systems usability and possibilities to improve the IT system require a hospital/IT management that understands the importance of usability and a vendor willing to perform the changes. In order to create that understanding it is crucial to:

1. Realise that when the same region-wide system is deployed in different organisation or departments, the end-users will use it in different ways. The differences can be explained by differences in context, needs, responsibilities and tasks.
2. Conceive the EPR deployment as organisational development, not an IT implementation.
3. Conceive the region-wide EPR as a tool for the users, in the continuous development of care processes.
4. Prepare the users, so that they will have optimal support during the go-live and post period. In this way, they can handle the change and adjust routines when the planned work process and the actual work practice do not fit together.
5. Prepare the users for the results. It is impossible to deploy a new system that will not affect the organisation. In fact, the meaning of the deployment is to affect the organisation and work practice. Only by doing so can organisations obtain the potential benefits.
6. Not to underestimate the importance of usability and possibility for the users to change and improve. If this is not supported it can have great affect on the users’ expectations, attitude and willingness to participate.

In conclusion we can see that there is a tension between buying and deploying a region-wide EPR system and obtaining a high level of efficiency and usability in the actual use situations. There is a contradiction in that EW systems work best if they are deployed and used according to the intended use at the same time as most work situations benefit from customised work procedures, IT-tools and support. A general trend and a success factor in many businesses are to develop smaller pieces of software or applications that are tailored for a certain type of activity. In that way, users can get good support in their work and at the same time access and share organisation-wide information. A way to accomplish this goal is to have EW information structures and business logic layers separated from the actual user interface and interaction. In other words, the whole region can share the same information and set of rules but have customised user interfaces, including the interactive workflows. For this situation to happen, we think that it is important for the health care organisations and the vendors to start to look into how to change the paradigm
from big “monolithic” IT-systems to smarter distributed software architectures.

**Summary points**

**What was already known on the topic?**

- Technology adoption is a sociotechnical transformation process in which existing work practices influence and is influenced by the technology.
- In order to understand the adoption of complex technologies, we need to investigate the realities of introducing technology in specific organisational settings.
- Large-scale information systems adoption in health care should be managed by a project-group, including not only IT-developers, but also representative of future users and management.

**What this study added to our knowledge?**

- Empirically based study about how individual users, and the organisation as such, are affected by the introduction of new region-wide IT systems.
- Five aspects, that can be seen as both reasons for success and barriers for user adoption when implementing region-wide health IT systems. The aspects are: (1) expectation, attitude and outcome, (2) management and steering, (3) end-user involvement, (4) EPR learning, and (5) usability and the possibility of changing and improving the IT system.
- The five aspects are all crucial and ignoring or failing to support any of them will negatively affect user adoption.
- The importance of conceiving the EPR deployment as organisational development, not an IT implementation.
- Limited opportunities to change the functionality are a major reason for poor user adoption.

**Ethics**

According to Swedish laws and regulations this research, based on interviews and observations of physicians’ and nurses’ attitudes and behaviour, do not need ethical approval by an ethical committee. All participants have been informed about the study and have been guaranteed to remain anonymous.

**Acknowledgements**

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**Appendix A. Supplementary data**

Supplementary data associated with this article can be found, in the online version, at [http://dx.doi.org/10.1016/j.ijmedinf.2014.02.003](http://dx.doi.org/10.1016/j.ijmedinf.2014.02.003)

**References**


**Authors’ contributions**

Rebecka Janols has planned the evaluations, performed data gathering, analysed the material and written the paper. Thomas Lind has planned and performed data gathering during one of the evaluations. He has also analysed the material and written the paper. Bengt Göransson has participated in the planning, performed some of the data gathering, analysed the material and written the paper. Bengt Sandblad has participated in the planning, analysed the material and written the paper.

**Competing interests**

No conflicts of interests for any of the authors.


Development of Novel eHealth Services for Citizen Use – Current System Engineering vs. Best Practice in HCI

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Abstract. Many new public eHealth Services are now being developed. Often a conventional customer-vendor process is used, where the customer is a public authority, e.g. a county council, and the vendor a commercial actor, e.g. an IT development company. In this case study the engineering process regards a novel eHealth service aiming to provide patients with online access to their electronic health record. A complicating factor in conventional customer-vendor processes for public e-services is that “the future user could be anyone”. In the light of best practice in Human-Computer Interaction, this study examines the joint effort of the customer and vendor when developing novel services for citizen use. The results include delimiting factors, recommendations for public authority customers and proposed new actions for the research agenda.

Keywords: user participation, public e-health services, e-government, electronic health records, system development methods, collaborative design, Scrum.

1 Introduction

In present study, health information is brought to the citizen via online public eHealth services on home- or mobile devices. One expectation of public eHealth services in general is to make patients more involved in their own health and empowered in their relationship with caregiver organizations [1]. Consequently, many new eHealth services with the aim to provide citizens with health information are currently being developed in Western Europe by both public healthcare providers and industry. One example is to provide patients with online access to their own electronic health record (EHR). Such a service can be seen as a public e-service which is a part of the e-government imperative. To date, main goals with e-government have been to reduce costs and time needed to provide services to citizens [2]. As a result, public e-services have mainly been developed from an internal government perspective, and external user considerations have been given little attention [3]. Studies show that neither public authorities nor citizens benefit from the introduction of such public e-services [2].

It is evident that increased knowledge of external user needs is essential for successful deployment of public e-services [4] and there is a growing interest for
citizen centeredness when developing public e-services in both governmental strategic documents [5] as well as in research [3]. However, it must be noted that user participation in public e-service development is challenging to put into practice. Public e-service development most often has to deal with a heterogeneous target group, i.e. all citizens [6]. Furthermore, citizens cannot be obliged to participate; their participation is voluntary, and performed besides their ordinary duties. Finally, procurement legislation and slim customer-vendor processes hamper use of user-centered requirement analyses. Consequently, and also due to traditional patterns, the process to develop public e-services is often based on conventional system engineering where future users are not involved in the development process. Public eHealth services provide no exceptions.

Present study adheres to Cooperative design [7, 8] as one of the Human-Computer Interaction (HCI) research theories that regards system development with user participation and that considers design a social process [9]. From research literature we know that usability aspects should be brought in early in the development process [9, 10]. Previous research also presents several methods to engage users in the future, like role playing and future workshops [9, 11]. Other methods to bring future needs analysis into system development are iterative prototyping and scenario-based design [8]. The latter is a well-used model in Participatory Design, also known as the Scandinavian tradition, developed since the 1970’s. [7]

The degree of user participation may vary. Regardless of activation degree, in cooperative design developers and practitioners/users are seen as active cooperating partners aiming to reduce uncertainty and risk in development of novel systems where no detailed conception of exactly which future needs should be supported and in which way [9, 11]. Also in User-Centered Design (UCD) [12, 13] active participation of users is preferred; there are however other methods and techniques to apply when potential end-users are not accessible, such as personas to shape future users [14], inspection methods to evaluate an interface [15] and use of representatives for real users [10, 13, 16]. In the light of best practice from the HCI domain, the purpose of this study was to investigate the actual development process of the customer and vendor when developing novel eHealth services for citizen use: How did customers from a county council and IT-developers from industry collaborate to jointly develop a public e-service for a third party, i.e. patients or citizens? To what extent were best practice-methods from HCI used in the development of this novel public eHealth service?

2 Methods and Materials

The studied project SUSTAINS\(^1\), is a European Union (EU) financed collaboration that aims to develop and deploy different regional eHealth services on 16 sites in 11 European countries by 2014. At the start of SUSTAINS in 2012, the majority of the partners had already initiated some development and results are now emerging. The County Council of Uppsala (LUL) in Sweden is coordinator of the EU-project and

The clinical eHealth services in LUL enable patients in the county to access and read their EHR, containing medical notes, drug prescriptions, medical lab results, diagnoses and referrals [1].

Development of these public e-services was performed in 2011-12 in a customer-vendor setting. LUL (the customer) was the initiator of this development and owner of the resulting eHealth services. The IT Company (the vendor) engaged in development of the eHealth services at LUL had previously been assigned to develop some of the predecessors of this current version. In November 2012 the eHealth services were made available to all, approx. 200 000 patients within LUL, following a minor launch in August limited to LUL employees (also considered patients) for testing purposes. Recently (in March 2013) a national strategy decision was made to deploy LUL eHealth services nationally; to provide all Swedish citizens with online access to their EHRs. This fact increased the interest to further study how novel eHealth services reach a heterogeneous target group, spread over an entire country, of different ages, education, health status and interests to use the services or to participate in the development process.

The Study: Research Team Evaluators and Methods

An action research project (DOME\(^2\)) was created by 16 nationally spread researchers to perform independent studies with multidisciplinary perspectives on the SUSTAINS EU-project. The four authors are members of DOME and each with an expertise in research areas related to eHealth: health informatics & HCI (IS), e-government & cooperative design (JH), IT & deployment processes (TL), organizational change & management control (GM).

When the research project was initiated (August 2012), the SUSTAINS project had already established a customer-vendor organization and current version of eHealth services was being developed. The selected data collection method was therefore to perform semi-structured interviews with SUSTAINS members from both sides. Three roles from the customer; project manager, project owner and medical advisor, were matched to the vendor’s development manager and two usability experts. Six interviews explicitly regarding the development process (table 1) were recorded and followed up by complementary questions and answers by face-to-face contact, phone as well as e-mails containing project documentation, requirements and system overviews from the vendor.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Reference in text</th>
<th>Affiliation</th>
<th>Length of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager</td>
<td>R1</td>
<td>Customer</td>
<td>60 min</td>
</tr>
<tr>
<td>Project Owner</td>
<td>R2</td>
<td>Customer</td>
<td>120 min</td>
</tr>
<tr>
<td>Medical Advisor</td>
<td>R3</td>
<td>Customer</td>
<td>90 min</td>
</tr>
<tr>
<td>Development manager</td>
<td>R4</td>
<td>Vendor</td>
<td>90 min</td>
</tr>
<tr>
<td>Usability expert 1</td>
<td>R5</td>
<td>Vendor</td>
<td>90 min</td>
</tr>
<tr>
<td>Usability expert 2</td>
<td>R6</td>
<td>Vendor</td>
<td>60 min</td>
</tr>
</tbody>
</table>

The recorded material was transcribed and analyzed by all four researchers using a content analysis model where the development process of the system was described according to the Systems Development Life Cycle (SDLC) [17]. This model describes the development process as constituted of three phases: initial; with various analyses, intermediary; system is realized, and finally; system is put to practice.

3 Results: Current System Engineering vs. Best Practice in HCI

The actual process of SUSTAINS development is compared to best practice methods and key principles in HCI and displayed in table 2. The initial phase (1) of SDLC concerns preliminary analyses, systems analyses, and requirements specifications (future users are identified and the project is defined with regard to its scope and expected outcome), the intermediate phase (2) deals with systems design and systems development (the system is realized), and the final phase (3) concerns integration, testing, installation and deployment (the system is put to practice).

Table 2. Initial (1), intermediate (2) and final phase (3) of SUSTAINS and Best practice in HCI

<table>
<thead>
<tr>
<th>Current system engineering process</th>
<th>Best practice in HCI (a selection of key principles)</th>
</tr>
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<tbody>
<tr>
<td>(1) A type of “Knowledge in the head”: customer representatives had previously studied pilot projects in Denmark, Estonia and the United States, as well as experiences of a predecessor of SUSTAINS, implemented at a private practice in LUL. These experiences were not systematically documented nor reported in the form of a systems analysis or similar. Future users were generally identified as inhabitants in the county. System specification existed in terms of an EU-consortium negotiation of a list of 12 features that should create the basis for the novel eHealth system. “Black box-approach”: There were no specified goals other than realizing the features listed by the EU-consortium. The scope was defined in terms of planned launch date, first access in summer of 2012, and a final launch in autumn of 2012. Neither users, nor developers were actively involved in the initial analyses of the novel eHealth services.</td>
<td>a) Identify main target groups for the intended service, b) categorize future users/most frequent users [9]. c) Analyze thoroughly potential users to elicit user requirements in terms of functionality and usability [7, 12]. d) Use requirements and project goals to steer development [9-11, 16] e) Stated goals and expected outcome are basic tools to create formative and summative evaluations [10, 18]. f) Participation of real users is preferred to decrease uncertainty and risks related to system acceptance, and a number of methods are presented in Introduction [7-9].</td>
</tr>
</tbody>
</table>
Communicating mental models: The vendor’s development team got involved and started by designing a prototype based on the 12 features. It needed to be redesigned with respect to a user perspective. Usability experts were called to assist; they performed a heuristic evaluation, a conceptual model and created 3 personas: an old demented woman and her relatives, a disabled child and his parents, and a woman with multiple diagnoses. Results were delivered to the customer that accepted to rebuild the prototype.

Changing requirements: The vendor used Scrum; an agile software development framework [19]. The development manager (i.e. scrum master) took the task to turn vague specifications into practically solvable requirements of the novel system. The Scrum process used iterations of three weeks, each ending with a customer demonstration using personas to get feedback for improvements and acceptance of each functionality. Users were not systematically incorporated in development activities but a focus group test day with patient organizations was a mandatory step in the EU-project. It is not clear whether/how this day was analyzed to improve the services. The vendor managed to simulate user participation when the customer assumed the role of user representative using each of the personas during demos.

Practice in practice: Only a few tests were carried out by the customer. The launch in August 2012 giving access to employees in LUL was a non-systematic test as each employee was free to use the system in the way she wanted. There was no systematic way of collecting reactions or questions from the users apart from a provided e-mail address as an option to feed back experiences. This option was sparsely used by the employees and no end-user education was provided. At service launch in November 2012, the same feedback system was used.

Discussion and Conclusion

The SUSTAINS Case: Analysis of current case has shown that HCI best practice was not followed by the customer for any of the three phases. Overall, the project applied a scarce amount of user participation. “The users’ needs were known to some extent by the aid of a survey conducted in 1999 and by the experiences made in the private
general practice” (R2) Instead of an inventory among patients today, the customer (particularly the project owner) tried to take on the role of a future end-user based on the reasoning that it was future end users’ needs which were of importance: “An average patient of today cannot know what she needs and demands from a future eHealth service system, as her views on and ideas of health and health systems will change, along with her own behavior”. Moreover, no stated project- or effect goals made development and evaluation difficult. The logic was, that “if a stated goal is invalid according to a future user it will not matter if the system can fulfill the goal or not”. According to HCI best practice, that uncertainty can be decreased using different user centered methods and techniques.

The vendor was only involved in the intermediate phase of the project regarding development of the services from specifications provided by the customer. Fortunately, the customer was supported by the vendor in handling some end-user issues and the moving targets. Use of an agile development method brought the common understanding of expected results forward as the customer collaborated closely with the vendor’s development team in frequent sprint demos. Further, an initial inspection evaluation led to redesign of the entire prototype as well as creation and use of three personas during development and sprint demos [19]. The usability aspects could be further refined, in many cases usability was neglected by the system’s owner: “As far as I remember no one was responsible for usability aspects” (R5). “We have made no usability testing of the system” (R6) and currently “no one knows whether the eHealth services are useful or only an online service” (R5).

**Recommendations to Public Authority Customers:** Although research has long advocated cooperative design methodologies, current public e-service projects are still technology-driven, instead of focusing on potential user needs. Use of existing and modified methods and techniques from the field of HCI as referenced here are of great value. In order to grasp this knowledge, it may be wise to incorporate HCI experts, not only from the vendor, but also internally, to establish a proper know-how of how to involve users to gain value out of the participation. In industry, usability experts are engaged in other projects, and only when called for their knowledge will be available for e-Government projects. It is therefore important to build in usage considerations early in planning and procurement documents, as well as working towards leaving conventional customer-vendor processes in favor of cooperative and agile methods. When HCI knowledge lacks at the customer end, which is not rare in healthcare, the developer must be given a mandate to handle these issues. In current case, the customer was led into development methods and processes selected by the vendor, in order to jointly develop a public e-service. In our opinion this project was saved by applying evolutionary prototyping, a thorough inspection evaluation and use of personas, where the customer meritoriously played user representatives using the 3 personas during iterative demos. However, working with future user-methodologies in a cooperative manner increases the likelihood for successful deployment according to best practice.
Proposed New Actions for HCI Research Agenda: By this study we inform the HCI domain where practice really is standing, and we propose a call for action, to support public authorities/public care providers by leading them towards a collaborative and user-centered development environment in an action research setting.

Constructive evaluations of novel eHealth services need to be performed, not only usability tests in a user context in current project, but in all projects. HCI researchers could assist e.g. in a triple helix-constellation with public sector and industry to build e-services that meet future users’ needs and possibly saving resources in the society.

Moreover, defined goals are needed. In this case e.g. how the system is intended to contribute to the patients’ well-being, how or how much the system should ease the pressure on different services provided by healthcare today, or what impact the new eHealth services should have on the workload of certain clinical staff. Support from research in creating e.g. efficiency goals would benefit public e-service projects.

There is a need for educational projects to educate the customer to handle development processes with public user (citizen or patient)-centered perspectives. HCI researchers would also do well as mediators between customers, users and developers.

Neglecting future users and usability aspects is not unique for the studied project, on the contrary. There are recognized delimiting factors that e-government initiatives are associated with and that the HCI community could study and propose e.g. guidelines for. Compared to e-services developed by commercial actors, public e-services must encompass both economic and democratic values at the same time as public administrations are regulated by laws to a large extent [20]. Being a public administration also brings the responsibility to provide e-services that provide clear benefit to the citizens since there is seldom an option to select another similar public e-service; they simply do not exist [21]. At last, users of public e-services are citizens with certain constitutional rights. Public e-services cannot exclude any user groups although they are not a majority of the users, instead all future users must be considered, taking into account different disabilities, geographical limitation, and language issues [22]. These delimiting factors make user participation in public eHealth service development a challenging and complex activity and best-practice methods are needed to support public e-service development. Future work is to further examine which HCI methods, and to what extent HCI methods, can support the process of empowering patients and making them more involved in their own health.

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References

A necessary activity towards moving healthcare services out of the physical premises of hospitals and into patients’ daily lives is to supply citizens with various health services via the Internet, i.e. public eHealth services. However, developing public eHealth services for a large number of heterogeneous end-users is a complex task.

This case study investigated the development process of a novel eHealth service that provides patient access to electronic health records, which was developed and recently deployed within the scope of an EU project.

A conventional customer-vendor process was applied that resulted in a high degree of uncertainty regarding end-user needs of this novel service. The development team tried to compensate for this weakness by using agile methods. When developing public eHealth services for citizens, it is imperative to involve potential users, to evaluate the citizens’ needs as a function of benefit, usability and security, and to handle those concepts responsibly throughout the process.

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Keywords

electronic health record, electronic patient record, eServices, evaluation, patient-centric, public eHealth services, system development process, ubiquitous computing, usability

In this case study, the customer – vendor – end-user relationships in the development of public eHealth services was investigated in practice and led to a number of recommendations to bear in mind when designing ubiquitous public eHealth services.
1. Introduction

There is mounting pressure on EU healthcare systems due to the prospect of a lack of resources in the future caused by demographic changes in the population, as well as people’s higher demands for improved treatment and care. As a result, healthcare authorities strive to streamline and standardise care processes through improved patient and information flows. There is a firm belief amongst many healthcare professionals and managers that one way to achieve improved quality of life for patients, while simultaneously improving control over healthcare expenditure, is to involve the patients in managing their own health (se2009.eu, 2009). A means to realise this is by implementing ICT systems that provide patients with access to their electronic health records (EHRs), and a number of other public eHealth services, reachable via e.g. mobile devices. These services aim at changing the role of patients, making them a more active partner in the healthcare process (Sustains, 2013) as well as improving efficiency and workflow across institutional and professional healthcare boundaries (CeHis, 2013).

In order to enable society to become the driver of its healthcare activities, appropriate tools need to be at the citizen’s disposal: demands for ubiquitous computing are undisputed in this matter. Public eHealth services are intended to support patients, relatives and care professionals by being accessible ubiquitously, i.e. anytime, everywhere and anywhere (CeHis, 2013). In contrast to traditional healthcare services located at physical care premises, public eHealth services could be accessed using any device, in any location and in any format, either on stationary or on various mobile devices.

There are known informatics challenges when creating patient-centric health and social care services for ubiquitous access. One of them is how to transfer patient data from the health organisations’ EHRs to the patient (se2009.eu). On a socio-technical level, the task for healthcare providers is e.g. to develop an ICT system that meets the needs and requirements of the patients, while at the same time being convenient and acceptable to healthcare professionals (for instance, physicians and nurses), and also economically sound from a societal perspective.

It is well known that the system development process creating health ICT is complex; it is difficult to plan (Samaras & Horst, 2005), and difficult to manage (Bradley et al., 2010). It has also long since been argued that ICT systems in healthcare must be designed with respect to the information requirements, cognitive capabilities and limitations of the end-users, as well as considerations of daily work in process-oriented organisations (Patel & Kushniruk, 1998).

Previous research highlights the need for a high degree of participatory activity from future users of a system in order to realise the expected end result (Olphert & Damodaran, 2007; Bødker et al., 2000). However, it must be noted that user participation in public eService development is challenging to put into practice (Axelsson et al., 2010). Public eService development most often has to deal with a heterogeneous target group if it takes on board all citizens (Henrikssen, 2004, Saha, 2008). Citizens cannot be obliged to participate; their participation is voluntary, and is performed in addition to their ordinary duties.

When developing eHealth services, the involvement of real users, i.e. patients, is desirable. However, the patients, in contrast to the clinical staff, are not members of the healthcare organisation, and accordingly are not easily reachable by the customer organisation (Scandurra et al., 2013). This consequently presents an even more complex situation when it comes to creating customer - vendor - end-user relationships in the development of public eHealth services.

In this case study, this situation was investigated in practice. It led to a number of recommendations to bear in mind when designing ubiquitous public eHealth services.
1.1 Objectives

Innovations in technology are driving powerful changes in the way citizens engage in healthcare delivery (O’rourke K, Heckman J, Elwood D, 2012). An interesting question is how and where a process of moving healthcare services towards citizens in their daily life starts.

This case study investigated the development process of a novel eHealth service, developed and recently deployed in a Swedish county within the scope of an EU project (Sustains, 2013), as an example of a step towards ubiquitous public eHealth.

In this EU deployment project, a Swedish county council is working together with an IT development company to develop and deploy a public eHealth service that aims to enable patients’ access to their own EHRs via the Internet. In the first phase, a regional service was deployed in November 2012, and made available to all patients in the county of Uppsala (Sustains, 2013). A second phase is currently in progress, where the aim is to scale this service to a national level and with the objective of providing this public eHealth service to all Swedish citizens (CeHis, 2013).

Following the recommendations of the European Commission in Horizon 2020 (2013) to strengthen public-private partnerships in research and innovation, a multi-disciplinary action research team is working alongside this EU project to study its effects and outcomes (DOME, 2013). In this study the action researchers focused on the development process through the analysis of interviews with the stakeholders involved.

The research objective was to highlight the activities performed in the development process that have a potential to increase patient empowerment. Furthermore, the aim was to point out potential implications and challenges that could impede a successful application, as well as to inform authorities, e.g. county councils, on successful methods for development and deployment before they initiate similar implementation processes.

2. Methods and materials

An explorative research approach was applied to undertake this constructive evaluation of an ongoing practice, namely how the development process was performed to create a novel eHealth service.

2.1 Empirical setting

The county council of Uppsala, Sweden, was the initiator of the development and also the owner of the developed eHealth service. The county council is the coordinator of an on-going EU deployment project (SUSTAINS\textsuperscript{1}) established in 2012 as a means to develop and deploy eHealth services providing patients with, amongst other services, online access to their electronic health record (EHR). There were two main actors involved in the development of the eHealth service: the customer and the vendor. The customer, i.e. the county council, has been an active participant and has been working in close collaboration with the vendor, i.e. the IT company’s development team. This vendor–customer relationship was initiated several years ago and the customer and vendor have been working together with predecessors and prototypes of the current eHealth service since 1997 (Figure 1). The development team currently works according to Scrum\textsuperscript{2} and was led by a Scrum master who has been

\textsuperscript{1} SUSTAINS (Support USers To Access INformation and Services) is an EU project that aims to introduce services that provide citizens with online access to their EHRs (2012-2014).

\textsuperscript{2} SCRUM in an agile software development framework for managing software development projects.
coordinating the development work as well as acting as the primary contact person to the customer. Besides the Scrum development team, usability experts were engaged in the development of the eHealth service addressing issues related to usability and user experience (Figure 2).

![Timeline Diagram](image-url)

**Figure 1:** Part 1/2 of the timeline for the development process

![Timeline Diagram](image-url)

**Figure 2:** Part 2/2 of the timeline for the development process
2.2 Data collection - Interviews

To gather empirical data from the development of the eHealth service, semi-structured face-to-face interviews were carried out during on-site visits. The respondents had all been active participants in the development process and represented the customer and the vendor in equal numbers. The aim was to gain insight into as many different aspects of the development work as possible. Respondents from the customer were represented by the project manager, the project owner (who is also the coordinator of the EU SUSTAINS project) and the medical advisor for the project. In the case description, these three interviewees are referred to as Respondents 1-3. Respondents from the vendor were represented by the Scrum master and two usability experts who were engaged during different parts of the development process. In the case description, they are referred to as Respondents 4-6.

The interviewers, i.e. the authors, altogether formed a multi-disciplinary research perspective, as each author stems from a different but adjacent research area such as Health Informatics, eGovernment, and Organisational Change and Management Control. By combining all their expertise on the problem area, their aim was to create a deeper understanding of the difficulties as well as the possibilities that arise in practice in development projects.

Each interview was held by at least two of the authors in order to cover and follow up on multi-disciplinary aspects. The length of the interviews varied between 60 (n=2), 90 (n=3) and 120 (n=1) minutes. Each interview was recorded and subsequently transcribed. In some instances where the collected material was judged incomplete, respondents were contacted again and further questions were asked of them in order to clarify and complete the earlier statements. These contacts were made face-to-face in some instances, and by email or phone in others.

2.3 Data analysis

The analysis focused on identifying activities that have a potential to increase patient empowerment and to point out potential implications and challenges that could impede a successful application, as well as to inform on successful methods performed during this development process.

In a two-step process, this paper analysed the development process of the public eHealth service with content analysis (Hsieh & Shannon, 2005) to identify correspondences and misalignments of the respondents’ answers.

The first step consisted of all four researchers reading the interview transcripts and discussing their implications amongst each other. Each transcript was summarised with respect to the objectives’ keywords which made it possible to outline a basic understanding of the studied intervention. Two core concepts were identified: activities performed during the development process and the results of the activities and decisions made during development.

In the second step, two researchers performed an analysis of each concept, searching for and identifying keywords. Thereafter the keywords were compared and adjusted for purposes of increased reliability, stringency and clarity. Early in this process, the paper’s authors collectively started to write their report by utilising an online collaborative word processing service and video conferencing meetings. This made it possible to make use of their different expertise, and to continuously develop and reconstruct their understanding of the case study. As a result, all four researchers have studied and processed the entire body of empirical material.
3. Results and discussion

This study of Uppsala County as a region in the EU project resulted in a description of how the process of moving healthcare services towards the patients’ daily lives actually started and progressed. Furthermore, a discussion was held regarding the challenges and lessons learnt as perceived by the stakeholders in the development process and the researchers studying this process.

3.1 Challenges when developing novel public eHealth services

The complexity of the system development process in eHealth is generally acknowledged in the literature as difficult to plan (Samaras & Horst, 2005), and difficult to manage (Bradley et al., 2010). Research also shows that ICT systems in healthcare must be designed by taking into consideration the end-users, as well as considering clinical work in the health organisations (Patel & Kushniruk, 1998). In the current case, when designing and developing a novel public eHealth service on behalf of the citizens or patients, but performed by the healthcare organisation and the IT development company, making room for such considerations was difficult. One of the problems stated by the development team was that of identifying the potential needs of a great number of more or less unique end-users from the medical treatment point of view. These end-users also have different experiences and understandings of IT. In this case, the customer emphasised that “the users have never seen a similar eHealth service, and they could therefore have difficulties imagining what it could be like and consequently find it difficult to pose demands for it” (Respondent 2).

Previous research has demanded a high degree of future users’ participation in order to realise the expected end result (Olpert & Damodaran, 2007; Bedker et al., 2000). Experiences from other eService development processes in public administration show that this is challenging to put into practice (Axelsson et al., 2010), as future users are a heterogeneous target group; their participation is voluntary and performed in addition to their ordinary duties; and they are difficult to reach for the customer organisation (Henrikssen 2004, Saha 2008; Scandurra et al., 2013).

This situation is exemplified by an evaluation presented by the Swedish National Audit Office which concludes that increased internal efficiency was the main motive for the initiation of public eService development projects (Swedish National Audit Office, 2004). This has led to a problematic situation where many development projects have been driven by “a techno-centric approach with minimal citizen involvement” (Sæbø et al., 2011), i.e. new technology, rather than perceived needs, has guided what kind of services were developed.

This complex situation presents a number of challenges when it comes to creating customer-vendor-end-user relationships for the development of novel public eHealth services. These are presented (below) as they also occurred in this project.

3.2 Activities performed during the development process

As stated above, the county council of Uppsala is currently a part of the SUSTAINS EU deployment project (Sustains, 2013). However, work towards ubiquitous patient access to health information was initiated in the county council as early as 1997. This novel idea was put into practice in various projects until a political resolution was accepted in 2009. From that point on, discussions regarding patient access to EHRs could depart at the county council from a more theoretical level towards planning for a full-scale implementation. At the beginning of 2011, the development of the public eHealth service was initiated by the customer in terms of informal specifications concerning what basic functionality such a future eHealth service could include. These specifications were
accompanied by basic regulations for the information that the eHealth service should, and could, reveal to the patient: which information, when, and how. Later in 2011, the vendor was contracted and development of a first prototype of the eHealth service was initiated. When a new head of system development was hired, who was also a Scrum master, the need for a more agile and iterative development process was made clear. The prototype needed to be redesigned with respect to the user perspective, and usability experts from within the company were called to assist. They performed a heuristic evaluation (Nielsen 1994), created a conceptual model of the public eHealth service and three personas\(^3\) in order to represent basic end-users’ concerns for how to interact with the system. The personas represented potential users: an old woman experiencing dementia (and her relatives), a disabled child (and his parents), and a woman with multiple diagnoses.

This material inspired the developers. It was also used together with representatives of the customer in so-called sprint demos, initiated as part of the development process of the system. The vendor performed three week-long development phases between each demo for the customer. The customer representatives usually included the project manager from the county council, sometimes accompanied by other members of the project, staff from the university hospital’s division of medical informatics and technology, and staff from the hospital’s administrative branch responsible for the EHR system. No representative of the end-users was involved in this work: instead, the project owner from the customer organisation acted as a potential future user.

The development work started from the customer’s initial list of informal specifications. This was however very broad, prompting the Scrum master to elaborate on the list to make it manageable. The finalised list consisted of seven modules and twelve functions, which the customer prioritised according to their perceived importance. The vendor was allowed to make changes in the priorities, e.g. if a certain function was not technically feasible, the developer could cross it out. At each sprint demo, the vendor showed the current state of the eHealth service and commented on what had been accomplished since the last demo. Reactions and feedback from all participants during these demos were collected by the Scrum master, and later analysed to decide if they should lead to corrections or changes.

In the early summer of 2012, as a mandatory stage in the EU-development project, the customer arranged a focus group meeting as an organised test day of the current prototype of the eHealth service. A problem perceived during the focus group day was that the guidelines for how to set up the test of the prototype were unclear. According to the development team, it was also not clear whether, or how, any feedback from this focus group day was used to improve the actual design of the system.

In late summer 2012, the customer carried out a first user test by enabling the county council’s own employees to use a prototype of the eHealth service, thus allowing them to access their own health records as patients. This was a non-systematic test as all employees were free to test the eHealth service in the way they wanted and the only prepared way of collecting reactions or questions from the users was through an e-mail address provided as an option for users wanting to comment on any (high or low-level) problem they encountered using the service; it could relate to e.g. interaction flaws, bugs, usability aspects or just reactions on how it felt to gain this access. The feedback was read by the customer and, if it was considered important, it was batched into the development process during the sprint demos.

Another finding is that there were no goals or fixed targets for the eHealth service. The customer

\(^3\) Personas describe basic characteristics of future users. The method is seen as an efficient tool for describing simple yet good enough models of users which can be used when designing system interactions, such as user dialogues or graphical user interfaces. See e.g. Gulliksen et al. (2003).
has deliberately refrained from specifying such issues as how the eHealth service is intended to contribute to the patients’ wellbeing, how or how much the eService should ease the pressure on other different services provided by the healthcare system today, or what impact it should have on the workload of the clinical staff in general. According to the customer, the reason for not being more specific is that it was not meaningful or purposive to state goals and targets that were perhaps not valid: “It might seem careless, but we’re the first out and we don’t know. Somehow it’s not meaningful to state a goal” (Respondent 2).

The logic was that “if a stated goal is invalid according to a future user, it will not matter if the system can fulfil the goal or not. In that case, the evaluation would be superfluous”. The customer continued: “If you on the other hand failed to state a certain goal, you will not be aware of the mistake until an end-user points this out to you, which will happen when the eHealth service is implemented and in daily use” (Respondent 2).

It is evident that testing, evaluation and end-user activities are not in line with best practices for user participation and user-centred systems development (Scandurra et al., 2013). The customer is well aware of this. Rather, the customer was aiming at satisfying the future end users’ needs and demands, and therefore claims that user participation at this stage would not be beneficial. Instead of making an inventory amongst patients today, the customer (and particularly the project owner) tried to take on the role as a future end-user. These arguments from the customer are easy to understand due to the novelty of the eHealth service being developed; future users, e.g. patients, have no baseline to refer to in terms either of missing functionality and possible improvements. This fact is also highlighted in research literature on user participation in systems development; user participation is not a guarantee for successful development projects, it just enhances the likelihood of it (Cavaye, 1995). Experiences from other ICT development projects could be summarised in the following way: it is not the invitation of users into the development process that ensures the design of a useful system. It is how well the users’ presence is planned and how their contribution is handled that matters and that subsequently creates the benefit of the collaborative work.

In the Human-Computer Interaction literature, methods are also available for how to create novel ICT systems: these stretch from adopting a low degree of user participation to involving potential users in the actual design and evaluation of ICT systems. The authors of the present paper argue that, apart from the user-centred activities performed in current development process, a collaborative design process consisting of future workshops and an iterative prototyping process (as in Scandurra et al., 2008) would have been beneficial to establish gradually an understanding between users and developers, and that mediators with knowledge from both health informatics and user-centred design (Larsson, 2013) would have been valuable as methodological support.

3.3 The results of the development process

A list of regulations formed a basis for the development of the eHealth service. This list was phrased by the customer (and formally decided on by the politicians of the county council). It regulates issues such as which information should be open to the patients, and when (whether in real-time or at a delayed time-period). The list of regulations was supplemented by a list of other basic requirements, which also emanated from the customer, that was developed as a result of the European collaboration in SUSTAINS.
3.4 Confusion regarding usability aspects

One aspect that was somewhat neglected in the development process was the intended usability of the public eHealth service. The development project is best described as an interactive and flexible process, where people from the customer and vendor were involved in different parts of the project and at different times. In reality this means that some of the involved actors have only seen bits and pieces of the complete system, or they only examined the functionality of the eHealth service from a specific perspective. An example here is the usability experts, who worked for a few hours spread over a period of time and who evaluated usability aspects exclusively in terms of the graphical user interface. Also from the customer’s side, some people were involved in other projects and switched their focus to this project during the actual process: “At that time I wasn’t so involved, I know a list of requirements was made … those steps [referring to the project owner, and coordinator of the EU project] knows more about” (Respondent 3). However the Scrum master at the vendor, along with the project leader from the customer, maintained an overall perspective of the eHealth service and its development.

The view of the eHealth service’s usability is heterogeneous amongst the respondents. There are no clear definitions in the development regarding concepts such as the service’s benefit, usability and security. The understandings of these dimensions tend to be blurred, and participants in the development have not, probably due to the lack of clear goals, discussed their understandings and/or expectations regarding these matters.

From the customer’s perspective the public, eHealth service is believed to be usable. As has been discussed previously, a number of various test activities have been performed during the development process, such as focus groups, sprint demos, and by having the employees in the county council use the eHealth service. However, the definition of the concept of usability was not discussed by the customer. When discussing this topic with the respondents, it is apparent that there is no unified view of it, and that several respondents do not differentiate between usability and utility, i.e. if the system is designed to fulfil specified goals by specified users (ISO 9241-11⁴), or if the system works as it is supposed to in terms of the more technical aspects of usage. A common belief among respondents from the customer is that this eHealth service is as usable as any other eService, such as Internet banking. Such types of eServices are considered to operate homogeneously, the customer representatives state: “Digital systems operate in a certain fashion….In comparison to these I perceive this system as highly usable” (Respondent 3), “It is like an Internet banking eService, and you don’t get any manual in order to operate these” (Respondent 2). In other words, there are diverse opinions regarding how to define the usability aspects of the eHealth service, and also concerning who is responsible for taking these aspects into consideration. When talking to the usability experts involved at the vendor side, it is evident that there are several issues regarding usability which need to be refined. The usability experts’ general opinion is that usability issues in many cases have been neglected by the systems owner: “As far as I remember there was no one responsible for usability aspects” (Respondent 5). According to the usability experts, additional time and resources would have been necessary in order to create a truly usable public eHealth service: “We have made no usability testing of the service” (Respondent 6).

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The analysis highlights the endeavour to reach a goal that was not pre-stated. There was a lack of a visible, defined goal, which made it difficult to test the eHealth service to get end-user feedback. What questions should be asked in this case? Another effect of the lack of a fixed goal was the difficulty of designing clear-cut roles of responsibility. In the present case, the customer and the vendor express a degree of uncertainty concerning where responsibilities start and end. This was shown by the small extent of, and late use of, usability analysis along with difficulties concerning how to document and incorporate responses from the actual user tests made.

3.5 Security issues

From a technical perspective, the eHealth service is considered to be secure and safe, both by the developer and the customer, with regard to privacy and confidentiality. This eHealth service uses the same authentication technology as other nationwide services, such as the health insurance office and the tax declaration office. However, on the one hand, there are some doubts regarding the availability of the eHealth service based on the fact that the service has not been tested thoroughly by end-users. As one respondent puts it: “Since we don’t have all possible scenarios it is hard to say what might happen” (Respondent 1). On the other hand, the service is considered to be non-critical, since it only displays information from the EHR system, and no data can be altered.

However, security may also be viewed from a patient perspective, concerning privacy and information quality. An obvious utility put forward by the customer is that patients will have immediate access to information from a healthcare visit and, by doing so, potential errors made by physicians may be reduced: “I believe that the correctness will be improved now when things can be checked twice” (Respondent 2). Despite the fact that access to the eHealth service is considered to be secure, there are doubts and concerns from both the vendor and the customer regarding the actual usage of the service, mainly due to the variety of possible usage scenarios. “There is a risk that we haven’t thought of everything, I believe we haven’t thought of everything” (Respondent 2). Regarding issues of security and privacy, there is a national regulatory work in progress, covering issues such as: What if someone read information over someone else’s shoulder? What if parents get access to sensitive information regarding their teenage children, which was not intended? These concerns, and others, will be addressed only after the public eHealth service has been made accessible.

The customer may also be criticised for not testing seriously enough various security aspects that are not connected to the national technical infrastructure. Perhaps security issues cannot be handled as easily as one respondent states: “If something unexpected happens we can always push the emergency button and shut it all down” (Respondent 2).

3.6 Expected benefits from the two perspectives

Expected benefits from launching the public eHealth service can be viewed from two related perspectives: that of the customer and of the patient. By offering EHRs to its patients, the customer expects benefits such as increased efficiency and improved medical quality, since patients will have direct access to information which in turn could reduce the need for information provided by the health staff: “They [the patients] will ask less if they know more” (Respondent 2).

From a patient perspective, the possibility to obtain more information much more easily is expected to make patients better informed, both before and after healthcare visits, as well when they get information rapidly regarding various conditions, such as through test results. On the other hand, the expected benefits are so far only expectations: “We start without knowing 100% what the results will be.” No evaluations were performed before the release of the service. Since this eHealth service is the first of its kind in Sweden, no conclusions can be drawn from previous or similar efforts.
4. Conclusions

A number of conclusions can be drawn from this study, that are related to activities performed in the development project. The developed public eHealth service itself has the potential to increase patient empowerment. However, the development process shows potential implications and challenges that could impede a successful application as well as successful methods that could be recommended to others before initiating a public eHealth service implementation process.

4.1 Potential increase in patient empowerment

Given the demands and promises for larger changes in the healthcare sector, it is evident that the inherent characteristics of novel public eHealth services pose several challenges regarding how to manage and exploit these services and technologies efficiently. One of the major challenges is to involve the “third party”, i.e. the citizen as the end-user, in the development process. This is unfortunately still not common in public administration (Axelsson et al., 2010). The public eHealth service development studied in this case provided no exception. Nevertheless, there are promising indications that this eHealth service, when widely used and studied using broader perspectives, will provide an increase in patient empowerment.

The history of this project’s development dates back to 1997. At that time the focus was on the technological advancement rather than on a user-centred development process, which is the case for many public administrative services. The heritage that today’s development team has to deal with is that decisions have often been technology-driven and not citizen-driven at all. However, the idea of this novelty has always been to increase patient empowerment by providing health information ubiquitously to the patient. The conviction was that the initiative would provide better opportunities for improved self-care, self-service and patient participation in the care process as well as raise the quality of the health information (Sustains, 2013). Another expected benefit is that the information is accessible wherever and whenever the patients desire, and is not connected to where the healthcare premises are located or when they are open (CeHis, 2013).

However, in the EU SUSTAINS deployment project, a central piece of future services providing ubiquitous health information is delivered to the citizen for the first time. Patient empowerment related to outcomes of the project and effects in broader perspectives need to be evaluated further (see the section of this article on Future Work). This should be done preferably by using key concepts such as benefit, usability, utility and security.

4.2 Potential implications, challenges and successful methods for recommendation

Initially, a conventional customer-vendor process was adopted. Results show that the development process was hard to plan and manage due to a high degree of uncertainty regarding end-user needs of this novel service. Previous research states the importance of end-user participation, which could have decreased the level of uncertainty.

The present study illustrates the difficulties in achieving this in practice. We consider that the recognised lack of end-user participation in this case, as in many other cases, is often based on a lack of previous experience and knowledge of methods that explain how to involve the users. In this case, it is evident that end-user and usability aspects were not involved in the planning of the development. The customer argued that it deliberately avoided involving patients as today’s patients were not acquainted with such a future service.
Regardless, the development team was convinced that, if the customer would have been more knowledgeable about usability and end-user involvement, other activities could have been included in the whole process to specify requirements explaining what the customer and the users need and why. However, on the one hand, we do acknowledge that user participation is not always successful; usability skills, knowledge of user-centred methods and clear goals are needed, factors that were not always available in this case. On the other hand, the situation improved when the development team was given the mandate to move towards using methods for improving the potential usability of the eHealth service. By adopting some of the best-practice methods that the Human-Computer Interaction (HCI) domain advocates, the subsequent development began to use tools to improve the understanding of the future users' behaviour, needs and demands. Activities to recommend are the creation of a conceptual model of the entire eHealth service, the creation of personas, and the use of an agile development method where the customer also acted as a future user representative during system evaluations.

There are also activities that we consider could use improvement.

Some of the most critical parts of the development process are to specify project goals, specify requirements and to evaluate those against potential user needs. In public procurement, the regulations require that the customer receives what is asked for, but the requirements are often based on a high level of abstraction and are therefore not explicit or traceable enough (Larsson, 2013). The work by the developers is facilitated much more easily if the goals are traceable to a low-level specification and the requirements detailed. Best practice in HCI states that iterative refinements of the system specification as well as iterative evaluations of prototypes performed with potential user groups will secure a better outcome to the development process (Scandurra et al., 2013).

This study emphasises that public eHealth services should be evaluated with regard to the citizens’ needs as a function of benefit, usability and security. It is also important that these concepts are continuously monitored in the development process. This can be reached by clear-cut roles of responsibility regarding the concepts within the project team, on both the customer and the vendor side. Clear goals and responsibilities would potentially have facilitated the focus group work, and the subsequent analysis of the work performed by patient organisations’ representatives would have provided a direct benefit to the development process.

Another desired improvement concerns the testing before launching the eHealth service in public. Best practice indicates that a user test should be set up that is as close to reality as possible. Probably due to technical security constraints, the sample selection in this case was the healthcare staff. The problem is that healthcare staff members have extensive domain knowledge and are accustomed to the electronic health record used in the county council. A suggestion instead would be to involve the focus groups’ participants, consisting of patient organisation representatives. They would have represented a potential future user better and the test results would probably have been more representative. Other recommendations are to carry through more thorough formative testing activities during the entire development process, and to carry through a summative user evaluation before the launch of the public eService. Such activities would follow HCI best practice.

Another conclusion is that the understanding of what is meant by the service’s benefit, usability, utility and security is blurred amongst the participants. These concepts are multidimensional and should include both technical and social considerations. Participants in the present case seem to view e.g. usability either as a technological functionality (that the service “works” = utility) or as a measure based on subjective interpretation (which can lead to a usable product = usability), with different understandings of how these two concepts are related.
A recommendation is therefore to plan for a workshop where customer and vendor discuss their understandings and expectations regarding these kinds of concepts, to form the scope, agree on common goals, and understand how to share the responsibility involved.

Finally, there are other contextual aspects outside the scope of this study that will have an impact on this and similar public eHealth services. Some aspects are elaborated in the following section on future work.

5. Future work

The public eHealth service that was studied was released in late November 2012 to the citizens of the county council of Uppsala. Presently, many citizens are therefore accessing their health records for the first time ever. Aspects such as usability, benefits and security, discussed in this paper, are expectations of usage of the eHealth services from different perspectives and have so far only been tested on a very limited scale.

A number of studies remain to be performed around the possibility of obtaining ubiquitous access to health information. This research team considers the study of the mere usage of such information to be more important than studies about which technical platform is used or through which mobile device the information is accessed, although such technically-related research studies may be interesting as well.

In the county council of Uppsala, a central piece of ubiquitous health information is delivered to the citizen for the first time. Thorough evaluations based on real usage are needed, wherein both patient perspectives (of real end-users), as well as those of the healthcare organisation need to be considered:

- How will public eHealth services induce operational changes? Which role can users play in designing new functionality?

- What benefits can be identified when using the eHealth service? What is the general opinion regarding the usability of the eHealth service?

- Has the eService been found to suffer any security, safety or privacy problems?

- To what extent is the eHealth service effective, efficient and usable for the intended user groups?

These aspects need to be assessed in relation to the novelty of such an eHealth service. In this case, patients are all novel users with regard to this public eHealth service. Consequently, findings resulting in such assessments should be evaluated in comparison with other domains, e.g.:

- Internet banking services (that today have been running for a long time with experienced users),

- conventional ways of accessing health data, and

- other public ICT services where the citizen can access data from authorities other than health organisations.
Other interesting studies to be performed regarding ubiquitous health information are related to potential spin-offs from this eHealth service:

- Do citizens actually need full access to their health records or is it something else? In which cases and for which patients?

- How can data provided by the health organisations be used together with patients’ personal health data inputs from existing or new applications?

- Which kinds of health information networks will be created when society becomes the real driver of healthcare activities? How will this change healthcare delivery and the way healthcare staff in different organisations work?

Finally, there are methodological questions related to how eHealth services should be studied, in which phase of development, and for how long.

6. References


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