How do hospitals learn and exploit new opportunities for innovation when implementing new ICT solutions?

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Master`s Thesis

Center for Technology, Innovation and Culture
Faculty of Social Science

UNIVERSITY OF OSLO

OCTOBER 2019

How do hospitals learn and exploit new opportunities for innovation when implementing new ICT solutions?

A case study of Electronic Medical Record

2019

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http://www.duo.uio.no

Abstract

This study explores how hospitals can learn and exploit new opportunities for innovation when implementing information and communication technology (ICT), exemplified by the electronical medical record (EMR). The study attempts to contribute to insight in the implementation process of an ICT in hospitals. In order to answer the research questions a qualitative case-study was chosen, and major significant factors for succeeding with implementation were studied. Based on 11 in-depth interviews with hospital staff and two observations, this study gives an understanding of factors that have contributed considerably in the implementation process. This thesis shares experiences that can improve future implementation processes in hospitals. Furthermore, the study reveals that users play pivotal in improving the EMR through learning, by doing, using and interacting (DUI-mode). A prominent finding is that user-innovation through feedback mechanisms and suggestions for improvements can contribute to incremental innovations. This study also indicates that feedback and suggestions for improvements do not follow structures routines, which hampers the successful implementation of EMR. The results of the study are underlining the importance of thoroughly education in ICTs and structured interaction across functions and clinics in the hospital.

Acknowledgements

This master`s thesis is the final part of my master`s degree in Technology, Innovation and Knowledge, at the University of Oslo.
The past two and a half years have been inspiring, work loaded and fun.

First and foremost, I would like to thank my supervisor, Erlend, who has provided me with invaluable feedback and guidance. Additionally, he has provided me with motivation and inspiration to conduct this study. Secondly, I would like to thank all the interviewees. Thank you for making your valuable time available.

To my friends and family, thank you for believing in me and supporting me. It has been tough, but your support has been invaluable. You are the best. Mamma, without your love, support, proof-reading and the work you have put in helping me, I would not have been able to finish this thesis.

All inaccuracies or shortcomings in this thesis is completely mine.

☺

Oslo, October 26th, 2019, Hedda Korsæth

Abbreviations

AHUH: Akershus University Hospital

DUI: Doing, using and interacting (mode for learning and innovation)

EMR: Electronic Medical Record

EPR: Electronic Patient Journal

Helse Sør-Øst: South- Eastern Norway Regional Health Authority

ICT: Information and communication technology

OUH: Oslo University Hospital

R&D: Research and development

STI: Science, Technology and innovation (mode for learning and innovation)

UiO: University of Oslo

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1 Introduction

Due to an aging and increasing population, higher expectations, cost-effectiveness and pressure on healthcare budgets and employees have to be handled. To meet these needs, innovation in hospitals and more efficient ways to work is vital (Meld. St.9, 2012-2013) The increased generation of new scientific data result increased specialisation and novel treatment options in health care, require new technological platforms aiming at supporting daily working activities for the clinicians. To achieve this, there is a need for changes and cooperation between technology providers and technology users (Sørensen & Torfing, 2012). New and more efficient ways to organise and communication across and between the hospital organisations are needed (Meld. St. 9, 2012-2013). Innovation, digitalization and implementation of new technologies in hospitals, in addition to cooperation across the sector will be vital in improving healthcare and contribute to a more efficient health care (Dips, 2017; Dagens Medisin, 2018). Use of technology in hospitals has become a noticeable topic in media and research communities, as there is an increasing frustration related to the implementation of information and communication technology (ICT) solutions among healthcare employees. It is suggested that user-involvement is vital in the development process (Sintef, 2019).

1.1 Research area and topic

My research area lies within innovation in the public sector and more specifically in healthcare. Innovation is a critical factor for development and survival of organizations in the public sector. Nevertheless, there is a common assumption that organisations within the public sector is risk averse and lack incentives to be creative (Albury, 2005; Matei et al., 2016; Potts et al, 2010; Schoeman, 2012; Gallouj et al, 2013). However, significant innovation has been found in the public sector, and the sector is more innovative than commonly credited (Gallouj et al., 2013; Potts et al., 2010;). In research, innovation in hospitals has been underestimated and underemphasized, in some cases wholly unrecognised (Djellal & Gallouj, 2005). Hospitals capacity to innovate is rarely directly or explicitly addressed in innovation studies (Thune & Mina, 2016). In an era where there is great public interest in innovation, hospitals are important adopters of novelty generated outside of the hospital (Salge & Vera, 2009; Thune & Mina, 2016). This thesis studies challenges related to

the implementation of ICT in health-care organizations, and how this potentially can be used as an opportunity for learning and innovation. This requires an information system that is designed to take full account for feedback mechanisms to guide further exploration in technology and practice. The background and motivation for choosing this theme and research question is based on Thune and Mina's suggestion for future research (2016).

> "New ICT investments related to telemedicine and big data can provide new opportunities for learning if the information system of the health-care organization is designed to take full account of feedback mechanisms to guide further exploration in technology and practice" (Thune & Mina, 2016).

The purpose of the study is to contribute to the public-sector and health care part in innovation studies. Thune & Mina (2016) argues that vast is written about the implementation of ICTs in hospitals within health management and health economic disciplines. Arguably, this study is of theoretical relevance as it is studied within innovation studies where research related to this theme is limited. This thesis applies the user-producer and user-innovation perspective, in addition to the DUI and STI framework in a hospital context.

1.1.1 The aims of this study

The aim with this master thesis is to study and examine how new health ICTs are implemented in a large and complex organization in the public sector:

1) To gain insight in the user's perception of the implementation processes and their role in this process.
2) To understand how user's meet challenges related to implementation of new ICTs, how they learn how to use it and how they exploit the advantages of a new technology. To study this, I have analysed the use and implementation of the EMR.
3) The overall aim is through this study to contribute to make future implementation processes of new technology easier.

1.2 Research questions

The overarching research question in this study is "How do hospitals learn and exploit new opportunities for innovation when implementing new ICT solutions". The contribution of this study is not to give an absolute answer to the overarching research question, but to contribute with insight on how an implementation process of an ICT has played out. The chosen case, is the EMR which is further described in chapter 5. In order to provide a deeper insight, three specific research questions have been made:

RQ1: What are the perceived advantages and challenges related to EMR?

RQ2: How do hospitals work with feedback and improvement of ICTs?

RQ3: Why is a synergy between DUI and STI crucial in the implementation process of ICTs?

1.2.1 Societal relevance of thesis

According to the Ministry of Health and Care Services, iimproving health care and digitalisation in healthcare and implementation of ICTs is a social responsibility (Meld. St. 9, 2012-2013). The theme and puzzle in this study is therefore of social relevance. The need for health care is increasing and we need to exploit resources better and improve patient quality. Health technologies play a significant role for us and can contribute to huge benefits for the public health (OECD, 2005). The health care sector have potential to change our understanding of disease, improved health and transformation of healthcare and is therefore interesting to study (OECD, 2005). Along with general technological development, hospitals Are increasingly using ICTs.

The applications, concepts and methods that are involved in ICTs are evolving almost every day and ICTs has no universal definition. However, ICTs are products that manipulates, receives, retrieves, stores or transmits information electronically in a digital form. There has been an ICT revolution the past 15 years, which has contributed to global development in an exceptional way. As a result of decreasing prices, infrastructure deployment and technological progress there has been an unexpected growth in ICT access and connectivity to billions of people around the world. The excessive evolvement of ICTs makes great opportunities for several sectors in improving efficiency and reducing costs, but also fosters

new issues that need to be considered. As the population can receive more information in real time, there are substantial points that need to be considered: legal issues, such as privacy and security, and social problems such as the digital divide (Gutierrez, Moreno, & Rebelo, 2017). According to the EU commission there is a need for more innovative, effective and high-quality healthcare (Wass et al, 2016). There are relevant on-going debate related to slow digitalisation in health care because of little user-involvement. The engagement in ICTs only evolves if the ICTs are seen as beneficial for the users. This requires that it is easy to user and that advantages are easy to identify for the user (Sintef, 2019).

1.3 Thesis outline

In chapter 2, I will present the theoretical framework that is applied for this thesis. This chapter presents the theories that implicate innovation studies, innovation in the public sector and in health care. Not all theories that are presented are directly relevant for analysing the empirical findings, however they are essential to understand the research area and the context that this study is involved in. The chapter starts with an introduction of definitions of innovation, technology and ICTs.

In chapter 3, I will present the chosen methodological approach and how I collected data for this study. Additionally, I will elaborate the ethical considerations, and reflect upon the study's rigor, validity and reflectivity.

In chapter 4, I will present the EMR case. This chapter is based on data from interviews and observations. With this chapter, I am to give an insight of what the ICT does and how it was implemented.

In chapter 5, I present the empirical findings related to research question one. In the end of the chapter I discuss the most prominent findings

In chapter 6, I present the empirical findings related to research question 2, and discuss these findings in light of the theoretical framework.

In chapter 7, I present the empirical findings related to research question 3, and discuss these findings in light of the theoretical framework.

In chapter 8, I discuss the most prominent findings and attempt to answer the overarching research questions. This chapter ends with discussing the limitations of this study and suggestions for future research.

2 Theoretical framework

This chapter will present the theoretical concepts that this thesis is based upon. For this study, I need a theoretical framework that lets me describe and analyse different aspects of the process to get an understanding of how a large public, and complex organisation works with and implementation of a new ICTs. First, the terms technology and ICT and innovation are briefly outlined. Second, general innovation literature and the concept of innovation are presented. Subsequently, innovation processes are briefly outlined. Next modes of knowledge, innovation and learning are presented. Subsequently, organisational innovation focusing on organisational structure will be described. Then, general public-sector innovation literature is presented, in order to described this study's context. The following section is more specific to this study, as innovation in hospitals literature is outlined. Lastly, the concepts of user-producer interaction and user-innovation is presented.

2.1 Technology

Regardless of various definitions, technology is often conceptualised as "applied science". Applied science means a manipulation of knowledge about nature to solve practical problems Another possible definition is to look at technology as a development of artefacts or instruments, that can be used to solve problems and knowledge about when, how or why these should be used (Sismondo, 2010). In this thesis, I will use an information communication technology (ICT) as a case to answer the research questions. Hospitals have increasing use of information and communication technologies (ICTs). It is an extended term for information technology (IT). As applications, concepts and methods that are involved in ICTs are evolving almost every day, ICTs has no universal definition. Nevertheless, ICTs are products that manipulates, receives, retrieves, stores or transmits information electronically in a digital form (Gutierrez et al., 2017)

2.2 Innovation

Innovation has existed for several hundred years, conversly it was merely studyied or described until the 1950 and 60ies. Within innovationstudies researches study how innovations develop and are diffused, what affects these processes, in addtion to what soscial and economicc consequences they have. Traditionally, innovationstudies have focused on commerical actors such as firms, entrepenuers and industries. Innovation is heterogeneous

across industries and sectors, and can occur under various knowledge environments (Fagerberg, Mowery & Nelson, 2005, ch.1).

2.2.1 Defining innovation

The term innovation has several definitions as it can be viewed from different perspectives and disciplines. The meaning of innovation is constantly under development, and it is used differently in different contexts. This thesis, along with the field of innovations studies, applies a Schumpeterian definition of innovation. Schumpeter, thought of innovation as a combination of existing idea, skills and resources in a novel way (Schumpeter, 1934). According to Kline & Rosenberg (1986), novelty does not only implicate the creation of new processes or products. Additionally, it involves small-scale changes in product performance that may over a period of time have considerable technological and economic implications (Kline & Rosenberg 1986). Schumpeter (1934), contributed to the innovation literature with a taxonomy where innovations are separated into different categories and which effect they have. The different categories are product, process, supply, market and organizational innovations. The effects are separated in to radical, revolutionary and incremental effects (Fagerberg, 2005).

Incremental innovations are often described as continuous improvements of processes or products, minor changes or adaptations to existing products or services (Albury, 2005; Lundvall, 2016). Usually, incremental innovations do not occur out of planned R&D efforts. Conversely, radical innovations typically arise out of deliberate R&D efforts. Radical innovations can for example be the development of new services, or a fundamentally new way of delivering and organising a service (Albury, 2005). Additionally, radical innovations are new products that transform existing industries and markets. Revolutionary innovations occur rarely, and are identified as they have a significant effect on several areas of the economic sector. Electricity is an example of a revolutionary innovation (Fagerberg, 2005).

2.3 Innovation process

Innovation does not only involve the creation of a novel idea or product, conversely it is the whole process from incretion to implementation of an idea (Garud, Tuertscher & Ven, 2013). Through time, there has always been different views on the innovation process. According to Garud et al., (2013), no model of the innovation process has received more critique than the

so-called “linear model of innovation”. The linear model of innovation sees innovation as a linear process, where innovation comes directly out of R&D efforts (Garud et al, 2013). Nevertheless, several scholars argue that innovation processes are have agreed on an evolutionary. The evolutionary perspective highlights that most innovation processes do not occur in orderly steps. However, these steps are not random either. The core of the evolutionary perspective is that the innovation process builds on variation (the emergence of something new), selection (the tidying of ideas that do not fit) and retention (the elaboration of the those who remain (Garud et al., 2013; Nelson & Winter, 2004). Furthermore, evolutionary innovation processes involve several levels of analysis. They implicate a set of social actors and material elements, also they evolve within contextual settings (Garud et al., 2013).

Kline & Rosenberg argues that innovation processes are not sequential or linear processes. However, they argue how it involves many interactions and feedbacks in knowledge creation. Additionally, they say that the innovation process involves learning that involves several inputs (Kline &Rosenberg, 1986). Furthermore, Pavitt, argued that innovation processes are messy and difficult to delineate or manage (Pavitt, 2006). However, Freeman as cited in Lundvall understood innovation as an interactive process, implying three phases; invention, development and implementation (Lundvall, 2016, s.231). Regardless of the different views on the innovation process, a majority of the literature point to the difficulties associated with development and implementation of new ideas. New ideas have to pass through several criteria’s over time, and as a result only some of them are successfully implemented (Garud et al., 2013).

2.4 Modes of innovation and learning

Research has proven that learning in practice and in research is crucial to successful innovation (Consoli et al., 2016). Jensen et al., (2007) have contributed to conceptualization of two ideal modes of learning and innovation the DUI (Doing, Using and Interacting) and STI (Science, Technology and Innovation) mode. These modes relate to different types of knowledge; codified and tacit knowledge. Define tacit and codified knowledge. Moreover, Lundvall & Johnson (1994) have developed a set of distinctions, that are helpful to understand the different mechanisms and channels through which learning different types of knowledge takes place: know-what, know-why, know-how and know-who. Know-what and

why can be attained through reading books, lectures and accessing data bases. Hence, it is codified knowledge. While know-who and know-how from practical experience, and is therefore related to tacit knowledge.

2.4.1 STI mode of innovation and learning

The STI-mode of innovation and learning will typically rely on codified and technical knowledge. Moreover, the STI-mode priorities the production of know-why and know-what (Jensen et al., 2007; Høyrup, 2010). STI-based R&D projects often implicate small groups of highly qualified members. Additionally, they are often formally conducted and managed as dedicated R&D projects. "The STI-mode often refers to the way firms use and further develops the body of science-like understanding in the context of their innovation activities" (Jensen et al., 2007). STI based R&D projects typically thrives from practical problems such as user needs, new products and processes. Furthermore, STI-based R&D projects typically begin with searching through earlier work, searching for pieces of codified knowledge, in addition to looking for insights that can be drawn from outside sources (Jensen et al., 2007; Salge & Vera, 2009). Moreover, the STI-mode focuses on the importance of scientific human capital and innovation infrastructure, for example public and private R&D organisations and universities (Apansovich et al., 2016). STI- firms are typically researchers, universities and other research organisations. Research shows that the STI interaction mode alone has stronger impact on technological innovation, such as product and processes (Parrilli & Heras, 2016).

2.4.2 The DUI-mode of innovation and learning

The DUI-mode is regarded as crucial to innovation and will typically rely on knowledge derived from practical experience. Furthermore, the DUI-mode is related to production of know-how and know-who knowledge (Jensen et al., 2007). The DUI-mode of innovation and learning is based on non-scientific drivers such as learning by doing, using and interaction. Hence, a vital factor in the mode is the interaction between people and departments. DUI-mode of innovation and learning is typically triggered by ordinary challenges that occur in daily practices. Hence, DUI innovation and learning often occurs unintended. As DUI- based knowledge thrives on learning by doing, using and interacting it is regarded as tacit and highly localised knowledge. Additionally, practice-based knowledge is deeply embedded in daily work activities, but is according to Salge and Vera (2009) highly distributed across the

entire organisation. DUI based innovation projects are typically conducted informally, which makes it difficult to separate innovation from regular work activities. Furthermore, DUI-based projects often remain hidden even to insiders within the organisation. User experience and demand in customization products contributes to productivity growth and innovation. Research shows that the DUI- mode alone tends to have a stronger effect on non-technological innovation (Parilli & Heras, 2016)

Jensen et al., (2007), stresses that even though there are two ideal types, they appear in a more mixed form in real life. The majority of studies of STI and DUI, investigate the most effective mode, however it well documented in the theoretical and qualitative case study literature on innovation that both STI- and DUI-mode of innovation and learning are important to the innovative performance (Jensen et al., 2007). Studies have shown that firms that combine STI and dui are more likely to innovate, compared to those who rely on either STI or DUI and that a synergy has stronger impact on innovation output (Apanasovich, Alcalde Heras, & Parrilli, 2016)

2.5 Organisational Innovation

"The creation or adaptation of an idea and behaviour that is new to the organization" is the broad definition of organisational innovation (Lam, 2006). Existing literature on organizational innovation is very divers, therefore there is no distinct framework. Nevertheless, it can roughly be divided in three research streams. The first research stream studies the link between organizational structure and its propensity to innovate. It studies how structural characteristic affects the organizations innovativeness. The second stream focuses on organizational learning, and how organizations develop new ideas to solve problems. While the third research stream concerns organizational change and adaptation, and the processes that causes the creation of new organizational forms. This stream focuses on understanding how organizations can adapt and meet the needs of the rapid changing market. Although there are distinct differences between the streams they do overlap each other. Traditionally, organizational innovation has concerned private organizations, and how they need to innovate in order to meet the marked needs and demands.

Conventionally, research within organizational innovation has focused on the factors that affects an organizations propensity to innovate. The main focus has been organizational

structure and how it affects the organizations ability to innovate. Even though an organization has large capital, a decent environment, expertise employees and essential resources, it will not succeed unless the organizational contexts stimulates to innovation. An organizational structure and processes that allows technological change is therefore vital to promote innovation. For example, an organization with a rigid hierarchic structure with little integration between functions and top-down communication, will most likely have little success with innovation (Lam, 2005). In the following section I will present literature related to organisational structure. This is important to understand related to the implementation of an ICT.

Organisational structure and innovation

Studies show that organisational structure can both be stimulating to or lagging innovation. Burns & Stalker (in Lam, 2005) presents two main types of organizational forms; a mechanic and an organic form and states that the key to successful innovation is it to find an equilibrium between these forms. Burns & Stalker (in Lam, 2005) describe how organic and mechanic organizations more or less are flexible to changes in specific environments. Organic organizations are best adaptable to unstable and unpredictable environments, conversely mechanic organizations are the best in environments that are stable and predictable (Lam, 2005). Furthermore, organic organization typically diffuse power in the whole organization, in comparison to mechanic organisations where power is centralized. In a mechanic organization, there are clear and distinct roles, whereas in an organic organization the employees have great autonomy and can choose their work activities. Moreover, in organic organizations, decisions are often made by personal interaction. Whereas, in mechanic organizations, practice and procedures are formalized and standardized. Mechanic organizations are typical in the public sector, whereas private sector organisations are often conceptualized as organic organisations. Organic organizations are more associated with innovation, especially radical innovations. (Lam, 2005).

Mintzberg (in Lam, 2005) says that successful organizations, design their structure to match their situation. According to Mintzberg, there are five different organisational structures; simple structure, machine bureaucracy, professional bureaucracy, divisionalized form and adhocracy. A simple structure is an organic organisational form, and these organizations are often small start-ups. In an organisation with a simple structure, the control is often delegated to one person. Furthermore, decisions are often made by one person, which can be a

disadvantage in terms of innovation. If an organisation become too dependent on one person, it is not sure that the decisions are conducted. However, the advantages with a simple structure is that decisions can be made fast, and they are often creative (Lam, 2005). The machine bureaucracy is a mechanic organizational form, and often consist a large staff where there are many levels between the top and the operative function. This structure is formalized and centralized. In terms of innovation the structure depends on specialists. A disadvantage with this type of organisational structure is its vulnerability to rapid changes in the market, as the employees are not specialists, and therefore cannot innovate. The professional bureaucracy is a decentralized mechanic organizational form, that consist of many professionals that have great autonomy and specialization. The decision-making is decentralized in organisations with this structure, which means that several employees can make decisions. The advantage with this structure are the employees technical and professional skills. While the disadvantage is that it can be difficult to lead individual professionals with a high degree self-determination and knowledge. Also, this structure can contribute to difficulties in coordinating across functions and disciplines, which may impose limits on the innovative capability even though the individual experts may be highly innovative. Hospitals and universities are typical organisations who have this organisational structure (Mintzberg in Lam, 2005). Djellal & Gallouj (2005,2007), says that hospitals are complex service organisations. A divisional structure is a decentralized organic form that has several independent units, that again have their own structure. The advantage of this structure is that the organization is able to concentrate about developing competence in specific niches and share knowledge whit the whole organization. The Adhocracy has a more “flat” structure and is often used in short team projects. The advantage with this structure is that it is adaptable and allows creativity, however it is a disadvantage that the structure lacks control and the team members can get to attached to the projects (Lam, 2005). What type of structure an organization has affects its innovation in terms of how information is shared with the whole organization. It also affects how fast decisions can be made, in addition to how fast changes can be made and how creative the organization is. Furthermore, the structure affects how adaptable the organizations is to its environment, the ability to learn and utilize external knowledge (Lam, 2005).

2.6 Innovation in the public sector

Studies of the public-sector innovation are found from around 1960s. Until the 2000s, most of these papers were written by researchers from a management or entrepreneurial discipline (Arundel et al., 2013). The theoretical literature focusing specifically on public sector innovation is scarce and limited (Bommert, 2010; Albury, 2005). Most research on public sector innovation are qualitative, and are often poorly conceptualized. In addition, they tend to lack a clear theoretical underpinning (Vries et al., 2015). Furthermore, a range of public-sector innovation studies are about process innovations (Borins, 2002; Gallouj, 2013; Albury, 2005). A majority of scholars have attempted to define public sector innovation, therefore there are multiple definitions. Arundel et al., (2013) argues that measuring and evaluation innovation in the public sector is difficult, as there is no clear definition of what public sector innovation is. However, there is a common understanding that it involves novelty and the intention to improve something. This can for example be improved products, services or processes (Arundel, 2013). Public sector innovation implicates something new or significant changes to services and goods, operational processes, organizational methods, or the way your organization communicates with others. Innovation must be new to your organization, although they can have been developed by others (Demircioglu & Audretsch, 2017). It is acknowledged that innovation is a critical factor for development and survival of organizations in the public sector. Innovation can contribute to smarter, more efficient and improved ways to work and perform (Cunningham, 2015).

Barriers of public sector innovation

There is a common assumption that the public sector is risk averse and lack incentives to be creative (Albury, 2005; Matei et al., 2016; Potts et al., 2010; Schoeman, 2012); Gallouj et al., 2013). However, significant innovation has been found in the public sector, and it is more innovative than commonly credited (Gallouj et al., 2013; Potts et al., 2010;). In fact, the public sector can be highly innovative. However, the diffusion can be slower and more difficult compared to innovation in the private sector (Albury, 2005). Traditionally, innovation studies have described how the private sector functions as an important selection mechanism. Innovating in the public sector meets barriers in terms of lack of funding, incentives, lack of skills, policy and risk of failure (Albury, 2005; Schoeman et al., 2012; Sun et al., (2018). Additionally, internal barriers such as time or incentives, and external barriers such as suppliers, rules and resistant users (Cunningham, 2015).

Commonalities between the public and private sector

As mentioned earlier in this chapter, most innovation literature is related to private sector firms. However, private and public sector have some commonalities thus the same framework is applicable for both sectors (Dermirogly et al., 2017). The public and private sector appear to have many of the same characteristics of innovation patterns and practices in the service production (Bloch & Bugge, 2013). Due to some commonalities, public sector innovation is often seen through the lens of private sector frameworks (Demirogly et al, 2017). Much of the past and current research on public sector innovation focuses on the positives rather than the negatives of innovation. This is because in the public sector there is a different incentive structure of innovation compared to the private sector, that rewards conventional knowledge and extensions (lessons and best practice) (Potts et al., 2010).

Collaborative innovation in the public sector

Bommert (2010), Sørensen & Torfing (2011) and Arundel et al., (2019) describe the growing demand for public sector innovation. These scholars suggest that collaborative innovation in the public sector facilitates to improved idea generation, selection, implementation and diffusion. By cooperating with other organizations and individuals outside of the organizational boundaries, knowledge, experience, and practices can be shared. Furthermore, Arundel et al., (2019) says that successful innovation depends on the ability to combine different strategies, and that support and collaboration with multiple partners can help solving problems and develop better solutions (Arundel et al., 2019). Bommert (2010), says that in order for the public sector to meet today's radical changes and needs, it needs to find new ways of innovating. Therefore, collaboration with other organizations and individuals outside to discover, develop and implement ideas within and outside of the organizational boundaries is suggested. Bommert (2010) further discusses whether collaborative innovation is suitable for the public sector or not and concludes that it is suitable, however not free from challenges.

Measuring public sector innovation

Demirciogly et al., (2017) has studied the likelihood of innovation activity in the public sector. The study shows that to achieve innovation in the public sector, motivation and experimentation to improve performance is necessary. Furthermore, the study shows that the

propensity to innovate varies across organizations in the public sector and that management and organizational strategies influence the innovation activity. Demirciogly (2017), says that the public-sector innovation literature lacks measurement for innovation. Arundel et al., (2019) describes how there is a growing interest for measuring and evaluation of innovation in the public sector, as part to improve efficiency and quality of public sector services. Bloch & Bugge (2013) develop a framework and indicators for measuring innovation in the public sector. However, public sector innovation is difficult to measure innovation in hospitals because it is hard to separate daily activities from innovation, because they often innovation as a result of trying to figure out how to solve daily activities (Thune & Mina, 2016).

2.7 Innovation in the health sector

Innovation in hospitals is not something new, as education, experience and innovative implementation of scientifically generated new data in patient treatment always have been the driving forces in human medicine and healthcare during the human history and are well documented in the published literature. Nevertheless, research on innovation in hospitals have been underestimated and in some cases completely unrecognized (Djellal & Gallouj, 2005). Innovation studies related to human health have emerged, and several of these say that hospitals are essential actors in innovation. However, hospitals are rarely addressed directly or explicitly in innovation studies (Gulbrandsen et al., 2016). Nevertheless, hospitals are treated as partners, contexts, users and indirect selection mechanisms in investigation of industrial development and commercialization of science (Thune & Mina, 2016). The majority of literature on hospital innovation explores hospitals as adopters of novelty that is generated externally (Thune & Mina, 2016). The history of medical technologies has covered the role of individual doctors as innovators, while health management and health economics have covered the hospitals role in consumption and implementation of innovations. As shown in Thune & Mina`s literature review, several scholars within the management and economic discipline have studied the implementation of medical or administrative innovation (Thune & Mina, 2016). Empirical investigations can be found in several disciplines and journals, however they often directly address health systems or health policy, where there are few theoretical frameworks and a limited degree of overlap and cumulative work (Gulbrandsen et al., 2016)

Traditionally, innovation studies have focused on commercialising innovations, however this definition is not sufficient for innovation in the public sector. Whereas in the private sector the focus is to make profit, the public sector and hospitals are supposed to treat patients and use technology to improve and safer treatment (Cunningham, 2015). In a hospital context, a novel idea can be a new product, such as medicine, information system or a medical technology. A novel service typically implicates a clinical procedure or nonmedical offering, such as a conference services or a hotel. Whereas a new process can be a patient pathway or therapeutic strategy. A novel organizational structure can be an organizational form or corporate structure (Salge & Vera, 2009). Health care innovation can be defined as "the changes that help healthcare practitioners focusing on the patient by helping healthcare professionals work better, more cost efficient, faster and smarter" (Thakur, Hsu, & Fontenot, 2012a)

Scholars of hospital innovation argue that hospitals function as a selection environment for medical innovations. This selection is very complex, there are several criterions are applied and the selection is strongly affected by policy and those who are in charge of this policy. Policy affects the idea generation and regulates how new innovations in hospital develop (Windrum & García- Goni, 2008). Furthermore, it is argued that feedback from medical and scientific communities affects this selection the same amount as patients and patient groups. Moreover, hospitals, especially University and research-hospitals are part of health innovation systems, and perform multiple functions. In addition to provide health-care services, they are users and adopters of new technologies. Hospitals are proven to be potential developers of organizational and process innovation. Additionally, hospitals are vital for reproduction, adaptation and generation of medical knowledge (Thune & Mina, 2016).

Health-care systems implicate different actors who perform diverse, yet related tasks that cannot be accomplished without the contribution of other agents (Djellal and Gallouj, 2005, 2007). Hospitals work as vital nodes in health-care networks because they perform multiple roles in the system. Furthermore, hospitals function as agents between diverse fields and sources of knowledge: such as clinical, commercial, scientific and technical knowledge. Hospitals can be seen as a connection between different modes of learning; through medical practice, technical experimentation, basic and applied research, and learning by adapting to local contexts (Morlacci & Nelson, 2011; Rosenberg 2009). Moreover, hospitals connect

health-care systems across stages in the innovation process, so that they can be involved in idea generation, testing, implementation and diffusion (Thune & Mina, 2016).

Furthermore, hospitals can contribute to new idea generation through experiential learning in clinical practice and research, also by identifying problems and possible solutions. When hospitals generate new ideas and solutions they often collaborate with universities and firms. Hospitals can internally initiate some product development activities. This is particularly related to the development of new methods, organizational arrangements procedures, services and tools (Windrum & García- Goni, 2008). Nevertheless, in the product development phase there is often an interaction between hospitals and established firms. This interaction is vital in order to transfer knowledge about the clinical context, where the new and potential products can be used. Subsequently, hospitals are involved in documenting and testing efficiency, effectiveness and safety of potential products such as ICTs (Windrum & García-Goni, 2008). It is vital for hospitals to take part in activities that are linked to the adaptation and learning in the user context, also the development of several service innovations to support the implementation of new treatment or technology. This is because hospitals can shape opportunities for technological learning due to experimental practice that can contribute to new ideas (Djellal et al., 2005; Metcalfe et al., 2005).

Thune & Mina (2016) identify three main research streams that address how hospitals are involved in generation of innovation: how medical staff contribute to innovation, hospitals as innovative organisations, and hospitals role in innovation processes and systems.

2.7.1 Health-care practitioners and their contribution to innovation

Some scholars have studied how health-care practitioners contribute to innovation, highlighting their significant role. These studies find that clinicians and medical doctors play an important role in the development of new devices and treatments (Kesselheim et al., 2014; Weigel, 2011). Furthermore, empirical case studies find that ideas for new products emerge in clinical setting, as a result of for example finding that current devices do not solve problems or aren't satisfying. These studies stress the importance of failure as a starting point for successful innovation (Consoli et al., 2016; Kesselheim et al., 2014). Moreover, a few studies link the doctor's role as inventors of medical devices as to their role as lead users and key partners for medical device companies that further develop and commercialize medical

devises. The patient's role in contribution to medical innovation is rarely investigated. Nevertheless, Bullinger et al., (2012) find that patients and patient groups are important and active members of innovation communities, especially in cases of rare diseases. Specialization and professionality is seen as a driver for technological innovation within medicine (Thune & Mina, 2016).

2.7.2 Hospitals as innovative organizations

Studies that concern hospitals innovativeness is very diverse in terms of data, empirical objects and key questions. These studies explore a range of issues. They have in common that they consider the amount of R&D and innovation as underestimated, because they involve activities and participants that aren't properly captured by standard indicators, such as new products, publications and patents. In hospitals, innovation is difficult to measure and observe systematically, because it is a result of a complex interplay among scientific units, clinical units and commercial units and often involve incremental technology and process improvements through learning by doing (Salge & Vera, 2009; Thune et al, 2016). Several scholars have studied hospitals role in generation of new or improved products, such as new drugs or medical devices (Rosenberg, 2009; Weigel, 2011). Djellal & Gallouj (2005)., find that innovation can occur in all aspects of hospitals operation. Furthermore, they claim that hospital innovation is very varied, involving organizational, medical practices and administrative practices that are bundled together in services (Thune et al., 2016).
Some research address hospitals organizational characteristics, and how practices may contribute to innovation at hospitals. They try to map whether hospital organizations foster creativity, entrepreneurial attitudes or learning among employees, and attempt to identify what affect these features have on innovation performance. The overall result is that hospitals that strongly focus on learning exhibit higher innovation performance. Only a few papers focus on the commercial aspect of hospital innovation activities (French et al., 2012).

Salge & Vera (2009) contribute to the studies of hospitals innovativeness, and points to the relationship between hospital innovativeness and organisational performance. They find two corresponding mode of innovativeness in hospitals; between science-based innovativeness and practice-based innovativeness based on the notions STI and DUI as presented earlier in this chapter. Salge & Vera (2009) finds that investment in both science-based and practice based innovation are beneficial to hospital performance. Furthermore, they elaborate how

DUI-based projects in hospitals can be driven by employees across all functions and hierarchical levels and is ideally highly inclusive. While the STI-mode of innovation in hospitals is skewed toward technical, clinical innovation primarily generated by specialist groups. Salge & Vera (2009) also stress the importance of creating a culture of organisational innovativeness through support mechanisms and effective incentives. This is because, research has shown that hospitals' R&D departments do not dedicate adequately support or attention to the latter exploration stages in innovative projects. Rather, they focus on the early phases of the innovation process which hampers the successful implementation of for example ICTs (Salge & Vera, 2009).

2.7.3 Hospitals role in innovation processes and systems

A few studies concentrated on hospitals role in innovation processes and systems, and how innovations in medicine and healthcare can emerge, develop and diffuse through these systems. These processes are characterised as an interplay of science, technology, medical practice and policy. Furthermore, they can implicate networks of firms, universities, government, patients and non-governmental organisations. Innovation processes in hospital are not only an introduction of a new medical service or product, rather an incremental, long and path-depended process that is influenced by medical practices (Gulbrandsen et al., 2016). Furthermore, innovation processes in hospitals are seen as recursive. This is because research on medical innovations show that they develop in an incremental manner and require substantial adaptation in many stages, considerable feedback from users, and considerable post-implementation development (Babera-Tomas et al., 2012; Consoli et al, 2013; Essen et al., 2013; Meriot et al, 2007; Mina et al., 2007; Petrakaki et al, 2015).

Studies related to the implementation process of ICTs in hospitals stress the importance of local adaptations and customizations to the software (Petrakaki & Klecun, 2015; Pollock et al., 2003). Pollock et al., (2003) further stresses that few large-scale information systems are developed from scratch. Producers typically employ product development strategies to meet the needs of homogenous market segments (Von Hippel in Jong, 2014). According to Pollock et al., (2003) this is found in the production of ICTs too. The supplier's aim is to make their ICT solution suitable into as many different settings as possible, and therefore ICT software often is designed to a market, not a specific user or client. It is common that software developers prioritize technical expertise before user's needs. There can be a distance related

to different goals and interest. There may for example be a conflict concerning what is "best practice" and what actually is best for the patient. Negotiation and interaction between producer and user is therefore vital before deciding on the elements in a health technology, that eventually can be standardized and used across contexts (Petrakaki & Klecun, 2015). Software applications that ICTs have, are often constructed by adapting existing packages to new organisational context and settings. Petrakaki & Klecun (2015) and Pollock et al., (2003) have studied how the Electronic Patient Record (EPR) required local adaptations and adjustments in order to be fully adopted. However, this is a challenge because ICT system does not easily translate across boundaries. Pollock et al., (2003), further discusses how it can be very difficult to adopt ICTs fully, because it is challenging to translate standardized software in to a new setting. Technologies often come with a standardized software, where there are limited possibilities to customize. As a result, many user-firms and consumers are not satisfied with these commercial products and are therefore triggered to innovate for themselves (von Hippel 2005 in Jong, 2014)

2.7.4 Barriers associated with innovation in hospitals

Barriers associated with innovation in hospitals is related to the size and complexity of the organisations. Hospitals are complex and composed of many interlinked systems, in addition to have very many employees with a high degree of professionality (Mintzberg in Lam, 2005). Studies have shown that hospital employees are resistant to innovation due to conservatism and defensive cultures. Also, professional resistance, unclear outcomes, technical barriers, heritage and legacy, accountability and absence of capacity for organisational learning is regarded as barriers for innovation in hospitals (Cunningham, 2015).

2.8 User-producer interaction

Whenever new knowledge is produced, it is important that the user interacts with the producer of the knowledge, in terms of feedback. The user-producer perspective says that interaction between the user and producer increases the chance of successful innovation to. Studies show that users often develop new functions for technologies, solve unforeseen problems and propose or even develop innovative solutions. Therefore, users are increasingly recognized as important sources and co-developers of innovations. Producers are interested in

societal acceptance of their products, in access to user's knowledge and in mobilizing the creative potential of users (Lundvall, 1985; Bradonjic, Franke & Lüthje, 2019)

Development of new technology needs close interaction between the user and producer When the technology is stable and standardized, a long distance between the user and producer can be efficient. However, when the technology is complex and ever changing, a short distance is preferred and important. A flexible, common cultural background might be important to establish tacit knowledge and decode complex messages. When an innovation has been developed and introduced, it will only diffuse if information about its use-value characteristics is communicated to the potential users of the innovation. Within organizations, this means that this information needs to be exchanged and interacted across individuals and departments in the organization (Lundvall, 2016).

2.8.1 National innovation system and user-producer interaction

Innovations do not develop in isolation, but rather in a system consisting customers, suppliers, competitors, partners and other actors. It is therefore more reasonable to look at innovation from a system perspective. Innovation systems include all of the important factors that affect the development, diffusion and use of innovations. Such as economic, social, political, organizational and institutional factors. The system perspective is used to ease the understanding for the innovation process, and can possibly be used to stimulate to more innovation. Innovation systems can be local, regional or national (Lundvall, 2016).
A geographical and cultural distance between the user and producer may inhibit the interaction according to the user-producer approach. By adding the system approach to the user-producer perspective it might explain why different national systems present different development patterns (Lundvall, 2016).

For several reasons, the interaction between users and producers that belong to the same national system seem to work more efficiently. A common language, a short geographical distance and the cultural proximity are the most important reasons. However, the national government is also an important factor. The national government has an important effect on the process of innovation and is underestimated. The government plays an important role by imposing standards and regulations making domestic interactions more efficient. Furthermore, in important instances the state interferes directly in the network and support

existing user-producer relationships. Because national economies have characteristic technological capabilities, international transfer of technology is not costless or impulsive. While some knowledge can be embodied in traded commodities, some parts are embodied in the labour force. Technology is not easily transferred internationally due to a limited mobility of labour across national borders. The national systems structure of innovation and production is a product of historical process, and can therefore not be transferred as easily as factors of production. This might be the most fundamental restriction to international transfer of technology. However, the importance of nations as frameworks for user-producer interaction does not rule of transnational interaction (Lundvall, 2016).

2.9 User-innovation

The last 10 years, the importance of user innovation has gained increased attention. Within innovation research the topic has become popular, in fact research policy alone has published 56 articles concerning user-innovation last 10 years. User innovation is a valuable source to innovation and it can cause negative consequences if it is underestimated. Due to technological development, the importance of user-innovation is likely to increase. User-innovation can be defined as innovations that are developed by users, rather than by producers (Jong, 2014). User-innovation is often triggered by concrete problems that the user has and often experienced as a self-rewarding (Bradonjic, Franke, & Lüthje, 2019). Innovation by users is perceived as an "invisible" phenomenon, as they rarely are commercialised and remain within the organisation. User-innovators lacks access to broader communication channels and direct marketing links. Therefore, most user-innovations are only known by the innovators themselves, or to the user community that they belong to. Nevertheless, users who innovate are often very willing to share their innovations with other users, but lack the incentives to actively promote or diffuse them (Bradonijc 2019; Harhoff et al., 2003; Salge & Vera, 2009).

Since 1970's and 80 a majority of studies have challenged the dominant view of innovation that says that innovation originates from producers and are supplied to customers through" goods and services that are for sale" (Baldwin & von Hippel 2011, p.1399), discovering that several of the most important innovations have originated from users, not producers. Documenting the prevalence of user innovation is crucial, as figures on this phenomenon are largely excluded from official statistics. User-innovation is underestimated because difficult

to measure. The measures for user-innovation often falls out of the standard indicators (Bloch & Bugge, 2013).

3 Methodological approach

In this chapter, the methodological approach for this thesis is presented. First, qualitative research is introduced and then cases studies are presented. Next, the data collecting methods will be explained: interviews and observation. Furthermore, the sampling process will be elaborated, and ethical concerns related to qualitative research in general, and this study in particular will be discussed.

3.1 Qualitative research

Qualitative research method is used to gain increased knowledge about other people's experience, thoughts, motives, attitude and practice. The goal is to achieve a better understanding and description of the research question that is studied (Malterud, 2003). Before a study can be conducted, several choices and considerations have to be made. One of the first decisions is to decide what you want to study, and in what way you are going to study it. This involves selecting a suitable research design, and consists of everything concerning research. The most used research designs are ethnography, case studies, phenomenology, "Grounded Theory" and experiments (Johannessen et al., 2011).
In this study, I hope to get insight in hospital in hospital leaders, doctors and nurses thoughts, experiences, ideas, attitudes and motives of the implementation of new ICTs. The aim is to understand how hospitals implement ICTs and exploit the opportunities for learning in such a process. According to Jensen et al., (2007) elements of learning are too complex to capture with survey-based methods and therefore a qualitative method is more applicable for this study.

3.1.1 Case study

"A case study is an empirical research, that studies a phenomenon in its real context because the boundaries between the phenomenon and the context are unclear" (Yin, 2009).
In this thesis, I will use a case study approach as research design to answer my research questions. Case studies are often used in market research, organizational research and social science. A case study design means that you study one or a few cases thorough. Case studies are more or less explorative. Normally, the researcher does not know what he or she is going to find. During the research, there might emerge themes or research questions that are important, but have not been discussed in the project description. A case can be both a study

object and a research design. Several researchers have contributed to the case-design literature, and Sharan B. Merriam (1998), Robert E. Stake (2000), and Robert K. Yin (2009) are three prominent names (Johannessen et al., 2011). In this thesis, I have chosen to apply Yins approach. Researcher who chooses a case-study design collects a lot of information from a few objects or cases over a short or long period of time, through detailed and in-depth data collection. Case studies are often performed by qualitative approaches, such as interviews or observation. However, the research design does not decide which technique you should use to collect your data, but there are some techniques that are more suitable for some designs. It is an advantage to combine several data collection methods, to achieve extensively and detailed data. Within social science there are especially two characteristics by a case; the attention is limited to the specific case, and there is a thorough description of it. The case is studied carefully and detailed in order to obtain as much data as possible. In other words, case study research consists of collecting as much information as possible about a limited phenomenon (the case). In this thesis, I have used two collection methods; observation and in-depth interviews. The transcripts from the 11 interviewees that I have conducted are the main source to my data collection. While the observation is used a supplementary material.

Yin (2009) says that there are five important components when you are performing case study research:

1. Research question. Qualitative case studies often start with a problem from practice. This can be a problem of general interest. Furthermore, the researcher asks a few specific questions that end up as a research question. For the case design, it is preferable to ask questions that affects a process (why or how something happens), and questions that deals with understanding (what, why and how).
2. Theoretical assumptions. The researcher often makes some assumptions after asking basic questions. According to Yin, these assumptions motivate future research.
3. Analytical unit. When the research question is defined, the next step is to decide on the unit that is (to be/ going to be) studied. The analytical unit or case can be a person, a program, an institution, a group, a happening or a concept. Furthermore, the researcher has to choose the number of cases.

4. The logical connection between data and assumptions. According to Yin, there are two analytical strategies: theoretical assumptions and a describing case study. Yin suggests researchers to use the theoretical assumption, and to only use the describing case study when you don't have a theoretical assumption in advance.
5. Criteria to interpret the findings. In this phase, you are to translate your findings alongside with already existing theory on the field/topic. Yin recommends having the theory ready before you collect the data. If you chose to do so, you can keep existing theory, modify and elaborate it.

According to Yin, there are two dimensions in the case study design. The first dimension is concerning whether you are working with one case or several. The other dimension is regarding your choice of one or more analytical units.

Table 1. Case Study design

Researchers limitation	Number of cases that are studied	
	One case	Several cases
One analytical unit	The researcher collects information from one unit (a person, a program, a group, a happening) within a limited system (organization, society)	The researcher collects information from one unit, within several systems.
Several analytical units	The researcher collects information from several units, within one system.	The researcher collects information from several units and several systems.

(Johannessen et al., 2011)

In this study there is one case, the EMR and several analytical units, the interviewees.

3.2 Positioning and understanding

According to Malterud, the researcher will always affect the research process and the results (Malterud, 2011). The same perception of reality can be described from different perspectives, however not all perspectives are not relevant for the research question that is

studied. Therefore, the researcher's position and perspective has a considerable effect for what knowledge that comes forth (Malterud, 2002). In qualitative methods, the aim is to reflect upon the interviewee's experiences and opinions. It is vital that the researcher does not supress the interviewees "voice". As a researcher, it is important to remain in the background and be aware of the affection that one has on the material. The researcher's preconception is an important factor, because it implicates the experiences, hypotheses, the professional perspective and the theoretical frame of references in the beginning of the study (Malterud, 2011). Furthermore, Malterud (2002) stresses how the researcher can be viewed as an active participant in knowledge development, and how this knowledge and position can have significance for what type of knowledge that comes forth. A decent analysis presupposes that the researcher is aware and is open about his or her starting point and position. Additionally, it is vital that the researcher reflect upon this and the consequences it can have for the results and conclusions of the research.

This study is the final part of my master's degree in Technology, Innovation and Knowledge at the University of Oslo (UiO). This master degree has given me a theoretical starting point for this study. I do not have any clinical experience and therefore no prejudice against using the case that is studied in this thesis and it has been vital to read business cases, white papers and operational documents related to the EMR. This has been important in order to gain an understanding of the situation, context, the rational for the importance of the implantation and the decisions that are made.

Table 2. Overview of secondary sources

Document number	Title	Author	Document type	Published
1	"Further implementation of EMR"	Cathrine Lofthus	Report	19.04.2018
2	"Regional Records"	Helse Sør-Øst	Business case	21.12.2017

3	"One Citizen-One Health Record"	White Paper	30.11.2012
4	Standardisation of technological solutions and working processes (2nd edition)	Report	17.12.2015

3.3 Sampling decisions, choice of hospitals and interviewees

The study's sample size is vital to protect a comprehensive perspective. The aim is therefore to attain a sample of interviewees that can provide information value of a high degree. I was hoping for interviewees who could provide descriptions that would increase my understanding of how clinician's implement ICTs. I therefore strategically chose interviewees who had insight and experience with the use and implementation process of the EMR.

The study is conducted at two different hospitals within Helse Sør-Øst. In one of the hospitals the implementation of the EMR is still an on-going process, whereas at the other hospital the EMR has been in use at all clinics for a few years. Interviews were performed at two hospitals to reflect upon the research question from different perspectives and positions. I have sampled interviewees from different clinics, functions and with different specialisations. The specific role and specialisation is presented in table X.

I aimed to achieve a sample that would give me a varied and diverse material that in the analytical phase would give access to alternative versions and interpretation possibilities (Malterud, 2011). The clinical leaders, administrative leaders and the interviewees were asked through an approval declaration to participate in this study. Furthermore, the interviewees were personally contacted to arrange an interview.

Table 3. Interviewees and roles

Interviewees/informants	Role
1	Doctor, R&D, internal partner
2	ICT Chief…, internal
3	ICT advisor, internal
4	Nurse, Head of section
5	Doctor, Instructor
6	Nurse, Team Leader
7	Nurse, "Super-user"
8	Senior consultant
9	Internal R&D, Operating administration and teaching responsibility in EMR
10	Senior Consultant
11	Internal R&D, Operating administration and teaching responsibility in EMR

3.4 Qualitative methods

3.4.1 Qualitative interviews

Kvale (1996) describes the qualitative interview as an interview that is centred on the interviewee's world. The aim is to describe and understand the central themes the interviewee experiences, and it is desired to gain as many nuances as possible. Precision in the descriptions and strictness of interpretation of opinions in the qualitative interview coincides with the requirements of precision in quantitative research. The qualitative interview has a descriptive orientation, where the researcher searchers for the interviewees specific description of situations and actions. It is not the general understanding that is studied (Kvale,

1996). It is essential that the researcher is open-minded and curious of what the interviewee says and what is not said. A decent qualitative interview is supposed to provide possibility for ambiguity (Malterud, 2011). The researcher has to be attentive for changes, and it is therefore important to develop sensitivity as a researcher. Additionally, it is important to be critical to own assumptions and hypotheses during the interview (Kvale, 1996; Kvale et al., 2009)

In the planning of this study I found out that performing interviews and observation would be the most appropriate qualitative methods to collect data. I was interested in the understanding of individual clinicians; it was beneficial to conduct individual interviews. It is crucial that the researcher is open-minded and is aware of his or her prejudice. This implicates being open and curious of everything related to the studied topic, and the awareness of own attitudes and opinions that can affect what is heard in the interviews. This study is performed at hospitals with interviewees that I had no intimate or personal knowledge of in advance of the study. The aim was to make sure that the interviewees felt comfortable to describe their thoughts and attitudes.

3.4.2 Interview guide

The qualitative interview should be conducted as a conversation where the researcher is open-minded, yet has a clear research question that structures the interview. This contributes to a focused conversation that implicates information enlightens the research question. A semi-structured interview guide was chosen for this study and functioned as a structure for the conversation. It was important that the interview guide was not to detailed, however it was vital that it functioned as a check-list for the themes that were desired to come up for discussion (Appendix, X). In light of the theoretical framework and research question, the following themes were chosen as framework for the interviews:

1: General information about the interviewees function and role
2: Why and how the EMR was implemented
3: Changes in the EMR
4: Organising for implementation of the EMR
5: Benefits and advantages of the EMR

It is essential that the interviewees feel safe and comfortable under the interview, so that they can talk freely and that the researcher is interested in what they are describing. No personal or intimate relationship to the interviewees contributed to a prejudice free and open interview situation. Open questions and no critical attitude towards the interviewees were strategic to make sure that the interviewee felt comfortable. I experienced it as a safe and open atmosphere during the interviews. The interviewees were engaged in the research question and the themes that I wished to talk about.

3.4.3 Observation

In this thesis, I have used observation as a supplementary data collection method. Observation is crucial to several types of research, however is commonly seen as inherently easy and of limited value. However, observation is more than seeing as it involves: touching, smelling, hearing and making explicit or implicit comparisons with previous experience (Kearns in Hay, 2010). Observation can be an effective, ethical and self-conscious sound practice given that the researcher has a crucial reflection. What we observe is influenced by whether we belong to the group we are studying or if we are regarded as outsiders. It is not possible to see everything there is to observe, therefore the researcher must always have an active role in the observation process. The main purposes to use observation as a method to collect data are: counting, complementing and contextualizing.

In this study, I performed two observations of clinical staff using the EMR. Observations were suitable to attain an understanding of the EMR's complexity and challenges that are described while using it. Observations have in this study been a complementary source to gain a deeper understanding of the phenomena that is studied.

3.5 Relevance, validity and reflexivity

Qualitative studies have been criticised for not following the requirements of science. There are especially critics towards the requirements that qualitative research has related to reliability, validity and objectivity. Validity is discussed as there are methodological challenges related to the researcher's role, the relationship to the interviewee sample, and how to make sure that the management and the interpretation of the material in the analysis process. Scientific knowledge is the result of systematic and critical reflection (Malterud,

2011), and the researchers most important divide to reliability is that the reader gains insights of the terms that the knowledge derived under. Systematic and reflective knowledge development that are accessible to vision, are equally important in quality and quantitative research. The researcher obligates to collect and work with the material towards a systematic concentration with the analysis of the research question (Malterud, 2011). The researcher role should be discussed by thematising motivation and preconception. In order to reflect upon how applicable the empirical findings are, the sample's composition and consequence has to be discussed and evaluated. The analysis process can be prepared by presenting the theoretical framework and the used method from data to results (Malterud, 2002). Malterud (2011) argues that the requirements of scientific knowledge are the studies relevance, validity and reflectivity.

Relevance concerns the research questions relevance. Implementing ICTs in hospitals is an important part of improving health care services, which is the Governments goal. It is therefore of interest to achieve more knowledge on how hospitals successfully can implement new ICTs and this study can therefore be regarded as relevant. Literature and steering documents were read to achieve a better overview and knowledge before the study was conducted.

Validity concerns how valid the empirical findings are, and if they are applicable in other contexts. The aim of the study is not to generalise, however to attain an increased insight in and understanding of the research question. I believe that the study's empirical findings are applicable to other implementations of ICTs processes in Hospitals.

Reflexivity is about how the research process has affected the findings and conclusions, in addition to the researcher critical attitude towards his or her method (Malterud, 2011). In qualitative studies, it is important with closeness to the studied phenomenon. The open and critical attitude to the completion of the research process is essential for the result to be perceived as trustworthy. In this study, I attempt to describe the methodological choices that have been made and what reflections I have done in this process, so it appears as transparent to the reader.

3.6 Outline and management of data

The interviews were conducted in Norwegian, and all interviews were recorded as they accepted it. There are at least two reasons to record the interviews. First, it verifies the interview and how it was performed. Second, it makes it easier for the researcher to focus on the conversation and the answers given by the interviewees. The interviews were saved by the numbered anonymised records on computer, also interview transcript was labelled with the number of the informant and saved on the computer. Individual interviews represent a time-consuming strategy for data collection and contribute to a comprehensive transcription and analysis. Furthermore, the data material consists of 11 interviews that lasted from 35- 60 minutes. The interviews were transcribed right after they were held. This was an extensive process that resulted in 46647 words. The interviews were transcribed without transcription software, because I believe that it helped me become more familiar with the interview data. All interviews were in Norwegian and were transcribed word by word. However, not all sounds or non-verbal communication were included. The data material was examined stepwise: after transcribing the interviews were categories in three potential research questions. In the end, I had three analysis that are presented in chapter 5,6 and 7.

3.7 Analysis of data

Systematic text condensation as presented of Malterud (Malterud, 2012) based on Giorgi (Giorgi, 1985) is used in order to analyse the data material. The analysis is performed in four steps: firstly, a general impression, then an identification of meaningful units and an abstraction of these units to summarize this. My data material consisted of 11 interviews that lasted between 35- 60 minutes. The interviews were transcribed almost word for word in order to protect the original material, the interviewee's experiences and opinions as they were perceived during the interviews (Malterud, 2002). The starting point for the analysis was the broad research question "What are the barriers and enabling factors associated with the implementation of new ICTs in hospitals?". Every interview was read through after they were transcribed, and then I conducted a comprehensive content analysis. Every interview was read through and organised in three themes that I recognized frequently in the material. Furthermore, I classified the meaningful quotes from the interviews in to the three potential research questions that derived from the theoretical framework. Then, I read through the organised material again and identified three main themes. At the same time, literature was read and these main themes were the starting point for the final research questions. This can be described an inductive reasoning, where I used the themes from data material and the

literature to develop the specific research questions. Inductive research involves the search for patterns from collected data, and it is based on learning from experience. The aim is to generate meaning from the collected data in order to identify patterns, resemblance and regularities (Johannessen et al. ,2011). A disadvantage with this design is that I did not ask specific questions to the interviewees.

3.8 Ethical considerations

All research has to be evaluated in terms of ethical reliability. Ethics is about the relationship between people, and deals with what we can do to each other and not. Ethics is not only about actions, but also the different ways we can directly or indirectly affect each other. When research directly affects people, especially when data is collected in terms of interviews and observation, ethical problems arise.

The basis for participation has to be based on voluntary informed agreement. The principal of the informant's anonymity is crucial to take care of. By informing the informants about the project, and then ask about interest in participating is protecting the informant's voluntary agreement. Voluntary agreement, anonymity, respect for the informant's private life, personal information, and professional secrecy are typical dilemmas that can arise in a data collection process (Johannessen et al, 2011).

3.8.1 Voluntary agreement and anonymity

To recruit interviewees, I sent out emails and oriented about the project. In that way, the interviewees had the opportunity to review if they wanted to participate or not. By doing this, the interviewees voluntary agreement to participate was taken care of. When performing the interviews, I informed the interviewee's that the interview will be anonymized, so that the results can be presented without a risk for recognition. An interviewee can for example be recognized if the work position and place is presented. It is therefore important to protect the interviewees anonymity, so that he or she won't be recognized. To secure the interviewees anonymity, I have not revealed which hospitals where the interviewee's are employed in this study. During interviews, it can be difficult for the researcher to take notes of everything that the interviewee says, and it can be useful to record the interview. Furthermore, it is important to ask every interviewee if it is ok to record and inform that it will be deleted by the projects end. This will also contribute to protect the interviewee voluntary agreement (Johannessen et al, 2011).

3.8.2 Norwegian Social Science Data Services

Anonymity will be protected in different ways if it is approved by the Norwegian Social Science Data Services (NSD) and completed in accordance to the rules they have set for proceeding projects. Records and saving of data from the interview has to be done without personal identification information, they have to be inaccessible for other researchers and they have to be deleted by the end of the project. Anonymity will be protected if none of the informants can recognize the other interviewees. I have directly contact every informant to arrange an interview. Quotation will not be marked in order to protect anonymity. When presenting the results, the informants anonymity will be protected by leaving out possible recognizable signs, without it diminishing the study's results and findings (Johannessen et al., 2011). This study is approved by NSD and can be found in the appendix.

3.9 The interviewees story

The goal with qualitative interviews is to elicit the informant's description of what is studied, how they experience and understand it. It is important to be loyal above the interviewees version of his or her story (Bailey et al., 1999). As a researcher, you can affect the interviewee and the material, and it is therefore important to remain in the background and be aware of the affect you have. It is unethical to expose the interviewee for unacceptable affection. It is unacceptable of the researcher to change the interviewee's opinion to what you thought the informant meant. This can lead to serious consequences for the informant (Johannessen et al., 2011). As a researcher, you have to treat the information that has come forward with respect. If you are uncertain of what an interviewee has said, you have to take contact with the interviewee and ask. This way you protect the interviewees story (Grossmann, 2011).

3.9.1 Respect for the informant.

Qualitative interviews often take much time, because the aim is for descriptions and understanding for the research questions that is studied to come forward. The aim is to achieve a more knowledge about people's experiences, thoughts, motives and understanding. It is unethical to be too bold and to ask questions that are embossing or uncomfortable for the informant. It is important that the researcher treats the interviewee and the information that comes forth with respect. In addition, it is important to give back to the interviewees, by presenting the results for them, so that they can make use of them (Grossman, 2011).

4 Contextual framework/ Background description of case

In this chapter, I will provide a background description of the chosen case that is studied in this thesis. This chapter starts with presenting The Southern and Eastern Norway Regional Health Authority (Helse Sør-Øst RHF), followed by a description of the ICT Electronical Medical Record (EMR). The aim with this chapter is to provide a description of what EMR is, and why it has become a widely used ICT in medical treatment. Following this section is a presentation of debates and issues related to the EMR in Helse Sør-Øst RHF found in media.

4.1 The Southern and Eastern Norway Regional Health Authority

The Ministry of Health and Care Services has the superior responsibility for all hospitals in Norway. The state owns all hospitals in Norway, and grants them with funds from the government budget. The specialist health service is organized in four regional health authorities, as of the new hospital reform from 2002. The South- Eastern Norway Regional Health Authority (Helse Sør-Øst RHF) is the largest of the four Regional health authorities in Norway with 78 200 employees, and owner of 11 hospital trusts. Additionally, Helse Sør-Øst has 5 private, non-commercial hospitals (Helse Sør-Øst, 2018).

The government ICT-development goals within health care services is that clinicians should have simple and safe access to patient and user information. The population should also have access to simple and secure digital solutions. Data shall be available for quality improvement, health supervision, steering and research. To reach these goals the government is working towards one record, new digital services for patients and users online, strengthening the national steering coordination of ICT development in the health and care services, and finishing on-going projects (Meld. St 9, 2012-2013). Helse Sør-Øst RHF, has worked for several years with the implementation of electronical medical record (EMR). In 2008, Helse Sør-Øst made a general agreement with EVRY, to purchase the EMR Metavision from EVRY´s sub supplier iMDSoft (Helse Sør- Øst, 2018).

EMR is a central documentation tool for daily activities at hospital clinics, and is important in the work towards improving patient security and quality. “EMR is the digital equivalent of paper records or charts at a hospital and it contains general information about medication, treatment, and the patient’s medical history” (USF Health, 2019). EMR is described in the hospitals ICT-strategy and plan of action from 2012 and 2015. The implementation of EMR has been a prioritized project in the three other regions as well, so that all health regions have had an on-going project related to EMR. As of 2018, EMR was implemented at three of the health trusts within the region: Akershus University Hospital Trust, Oslo University Hospital Trust and Østfold Hospital Trust (Helse Sør-Øst, 2015). Helse Sør-Øst aims to finish the implementation within 2021.

The regions overarching goal is to better the patient security and quality. This requires adequately involvement from the health enterprises and clinical networks in a structured way. In line with the whitepaper “One citizen – one journal”, the aims for the ICT-development in health Norway is set. Clinicians shall have easy and safe access to patient and user-information. Data shall be accessible for quality improvement, health surveillance, research and steering (Meld. St.9. 2012-2013).

Originally, EMR was made for an intensive unit care, and was already in use at AHUS back in 2000. However, it was in 2014 that it was implemented at all clinics. Electronic Medical Record (EMR) replaces several paper-based working processes. ERM main task is to contribute to easier information flow and to give higher quality patient documentation. This can contribute to increased patient security, new working methods and better patient service (Helse Sør-Øst, 2018). Furthermore, EMR can produce quality data for research causes, quality leadership and administrative needs (Regional Health Authority, 2019)

4.2 Case study of the Electronic Medical Record (EMR)

Medical errors have been a considerable source to serious treatment errors in hospitals (Helse Sør-Øst, 2018). This section will describe the EMR, what it is and what it is used for. The Electronic Medical Record replaces the paper record and the paper-based medication documentation that hospitals have used earlier. A medical record is documentation that supports planning, observation and measures for every individual patient. It covers a patient’s

pulse, temperature, blood pressure, fluid balance, all prescriptions and administration of medication. In Norwegian, medical records are called the charts and not records because some observations are portrayed graphically on a timeline. An electronical medical record can provide clinicians an improved and a more structured overview of the patient's condition and their medication compared to paper-records. This can contribute to reduce patient injury and medical errors, in addition to better clinical decision support and quality. This is because it gives an overall view of measurements and observation for each patient. This includes the patients' blood pressure, infusions, laboratory results, medical dose, temperature and fluid balance. The documentation follows the patient between clinics and hospitals. The EMR can also function as clinical decision support, because it compares the patient's data to other measurement. All information about on-going and scheduled treatment is easy accessible for clinicians. Electronic information flow contributes to safer and more efficient internal transfers. Gathered data contributes to a better overview and ability to faster diagnosing. The EMR opens up the concept of so-called "closed loop", which means that the right medication is given to the right patient, because ordination, medication and identity is electronically controlled (Helse Sør-Øst, 2018, s.2-8).

4.3 EMR in Helse Sør-Øst

It is anchored in the hospitals leadership in Helse Sør-Øst that the EMR should be in use at every clinic at the hospital within 2021. The aim is to have a thorough medication record, meaning that it follows the patient through the whole hospital stay, even though the patient might be transferred between clinics. The implementation process has had setbacks as there have been challenges along the way. In February, "Dagens Medisin" wrote that the Orthopaedic doctors at OUH refused to use the EMR and had received allowance to use paper record instead. The leader of the Orthopaedic clinic expressed how EMR is too time-consuming for busy Orthopaedics, and that they had difficulties in implementing the system because of lack of synergies with existing ICTs that had created situations that were not to cope with.

> "The clinic has after excessively and closely evaluations, chosen to continue using paper records for documenting medications at Ullevål and Rikshospitalet. There are several reasons for this choice, and is in general concerning the need to use resources

> efficiently and towards patients. The way EMR worked when this decision was made, was perceived as a barrier for the employees to secure medication of patients, follow the patient and secure quality in line with our routines" (Riise in Dagens Medisin, 2019).

The same perceptions are described in "Overlegen" (2019). In this article, it comes forth that clinicians find the EMR slow, too inconvenient. Furthermore, clinicians complain that and that the system ca cause serious dangerous situations for the patients. Also, the doctors experience that they spend too much time of the computer using the EMR and that this gives them less time on patients. Moreover, it comes forth that lack of interaction between the EMR and the electronical patient journal (EPR), "DIPS" is a challenge. Additionally, clinicians experience duplication of work, as the EPR and EMR share some documentation. The main point taken from "Overlegen" and "Dagens Medisin" is that the clinicians are frustrated that they have to use an ICT that they perceive as unfinished and an inconvenient tool in their job.

5 Research question 1, “What are the perceived advantages and challenges related to EMR?”.

In chapter 4, I presented the electronical medical record case. This chapter explores and discusses the empirical findings connected to research question 1: “What are the perceived advantages and challenges related to EMR?”

The empirical findings are based on interviewees with eleven hospital employees with different specialisations and functions, as described in chapter 3. Moreover, some of the empirical findings are based two observations. In order to answer the three research questions, I will present and analyse my empirical findings in a three-fold structure. The first research question is related to the EMR functionality and of a descriptive character. It discusses what EMR does well and what it does not do well. These descriptive empirical findings create the basis for research question two and three, and were necessary to understand first. Secondly, I discuss how hospitals work with feedback and improvement of ICTs. Lastly, I explore and elaborate why and how both DUI and STI mode of innovation is important during an implementation of ICTs.

5.1 RQ1: What are the perceived advantages and challenges with EMR?

In this section I will present findings that are relevant for the first research question. I have investigated what the interviewees perceive as benefits and challenges related with EMR. My findings suggest that the challenges related to EMR can be better understood through how hospitals work with improvement, feedback and learning processes that occur in the hospital. I will therefore apply the descriptive findings revealed by research question one to understand why and how it is performing at its current state. First, I present the positive associations related to EMR that have come forth in my data.

5.1.1 Advantages and positive perceptions related to EMR

In the following section I will present the most prominent findings recognized in the empirical data (illustrated in table X). During the interviews, I asked the interviewees specifically what they thought were beneficial with having an electronic medical record compared to paper records. I noted five positive perceptions that nine of the eleven interviewees mentioned: easy to use, documenting medication, accessibility and traceability. Whereas interviewee 5, pointed to potential spin-off effects as a great advantage.

User-friendly

Of the eleven interviewees, there were 4 who elaborated how the EMR is notably more difficult to use compared the analogue paper-record. "The system is not intuitively understandable. You have to know where the functions are and which buttons to press. Especially the doctors would rather have someone else do it for them (Interviewee 2)". Interviewee 3 had some responsibility in teaching users in EMR, and elaborated how the users perceived EMR as easy to learn during the course, but how it turned out to be more challenging to use in practice. Moreover, Interviewee 8 expressed a deep frustration: "You do not have the visual overview that the paper records had. To gain insight over a medical treatment is difficult because there are a ton of ways to do it. The graphs in the EMR are impractical (Interviewee, 8)". Also, it is obvious from observation that EMR has numerous tabs, windows, functions and is a rather complex system. Nevertheless, most of the interviewees expressed that they find EMR as a self-explanatory system, and that they figure out things along the way. The system has pictures and explanations, which describe the function of the different tabs and banners. Additionally, EMR requires that the users have a higher level of computer skills. One interviewee's states that: "I find it rather easy to put in medication and sign for them" (Interviewee, 7)

Based on observation and interviews, it is obvious that EMR has numerous windows and tabs that the user can click through, and there are several ways to perform one task. A consequence of this is that the user-surface is perceived as confusing and not intuitively understandable compared to the paper record. As interviewee 8 states it:" It is very unclear and therefore difficult to protect the patient security, because the potential for making mistakes is big"

As interviewee 7 states: “There are many who find EMR disorganised. It is organised for the exact day that you are doing things, but in order to see what was done the day before or what is going to happen tomorrow then you have to find this in another tab”.

Continuous documentation of medication

10 of the interviewees pointed to continuous documentation of medication as one of the biggest advantages with EMR. EMR is a complex system and it requires punctuality and accuracy. The user has to make several considerations in EMR, compared to a simpler analogue paper record. The interviewees express that they have a more conscious attitude towards medication, because of choices and decisions that they have to make in EMR. This can contribute to better decision support, quality and safety (Helse Sør- Øst, 2017). Documentation can be illustrated through the following statement:

> I believe that the biggest advantage is documentation. There are so many fields that you have to fill out. Therefore, it becomes a step-by-step process. You have to make more choices in EMR, compared to when we used paper records. Now, you have a more conscious attitude towards medication (Interviewee 11).

This point is supported by another interviewee: “Even though it takes more time, I find the EMR better than the analogue paper-records. It is quality assurance, because of you have to take more things in consideration in EMR compared to the paper record” (Interviewee, 6).

EMRs purpose has been to increase the patient security and reduce the medication errors, as medical errors have been a challenge (Helse Sør-Øst, 2015). Wrong use of medication, and medication to the wrong patient and the wrong dosage has been a challenge in health care. Moreover, EMR is implemented to better the quality of the patient treatment. Due to more tabs, banners and considerations that have to be made in EMR, it is more time-consuming compared to the previous paper-records. However, Helse Sør-Øst says that EMR is supposed to be speedier than the paper-records. Although, the users express that they spend more time on using EMR, they highlight the importance of quality and security, which EMR provides.

Accessibility

EMRs accessibility comes forth as one of its biggest advantages. EMR is accessible for the users from every computer at the hospital or even at home, at all times. Conversely, there was only one copy of the paper-curve. The interviewees explain how they earlier spent much time finding and tracking the paper-curve, because it happened to disappear. EMRs accessibility is beneficial for several reasons. If a prescription is needed at one division while the doctor is at home or at a different division, it is still possible for the doctor to prescribe medications. In addition, EMR makes patient transfers between divisions easier. Previously, paper-curves would disappear during a transfer. The advantage of accessibility can be illustrated by the following interviewee number 5: "Earlier, we spent much time looking for paper-curves. Now, everyone has access from a computer anywhere at the hospital, or even at home". In addition, interviewee 5 stresses that there is less confusion with EMR: "There are no curves that disappear. Earlier, there could be misunderstandings because someone had written imprecisely or incorrect"

Traceability

Several of the interviewees point out traceability as a huge advantage of the EMR. In order to use EMR, the doctors and nurses have to log in with their username and password. A consequence of this is that you can track and see which clinician who has signed or prescribed a medication or treatment. Therefore, if a mistake is made or someone is curious of why a certain choice was made, it is easy to track the clinician and understand why it is done. This contributes to better safety for the patient, because it contributes to correct ordination and reduces the potential for mistakes. The advantage of traceability was illustrated by interviewee 7 this way:

> I see traceability and internal control as an advantage. You can track the person who prescribed or gave a medication. It is a lot easier to track mistakes. If a doctor prescribes the wrong medication, you can discuss it with the doctor who did it, although it is a very transparent system.

Moreover, interviewee 7 stresses the point that patient security increases due to traceability.

> If something happens in the future, it is easier for the patient to go back and look at what was done back in time. It is easier to track mistakes or damages. In addition, EMR records does not disappear. Let's say a patient is ill and there is a chance that it

is a mistake made by the hospital, but the paper record is missing. That does not happen now. That is an assurance for everyone.

Spin-off effects

Another advantage of digitalising the medication record is that EMR can produce quality data for research causes, quality leadership and administrative needs. Data from EMR can be used to track the amount of blood that is used within a set time. Data from EMR can also be used for tracking the use of antibiotics. Due to antibiotic resistance, the use of antibiotics is a much-debated theme. It can therefore be useful to track the amount and type of antibiotics that are given. However, it comes forth that there are few of the eleven interviewees who actually know how to use data from EMR for so-called spin-off effects, but they say they know that it is possible. Interviewee 5 expresses the potential for spin-off effects:

> Another advantage is the potential for spin-off effects. You almost take it for granted from an electronic system, you can collect aggregated data. Firstly, I am thinking about medication consumption. How many bags of blood is given, how many doses of antibiotics is received, how long have patients has received antibiotics and what type did they get. These are data that I can collect. I would say that the report functionality is one of the biggest benefits.

The Regional Health Authority highlights the ability to produce data for research as one of their main advantages. However, there is only one of the interviewees who mention that this is possible. This indicates that interviewee 5, as an instructor might be highly motivated and interested in EMR.

Standard packages and forms

EMR is built up by mostly tabs and banners, there is little space for" free-writing". The EMR system comes from iMDsoft, a company in Israel. It appears that it comes with a set of pieces that IT-specialists and designers, mainly at R&D division in hospitals, can arrange way they want. However, if they need new pieces iMDsoft has to evaluate if that is something that they want in their system. The changes that iMDsoft make are the same for every hospital that

they deliver EMR to. It is possible for the Regional Health Authority to configure the EMR in several ways, and you can choose between premade packages and forms. It can for example be a premade list of medicines for one specific treatment. In the paper record, the doctor would have to write down the different medication in a treatment, which took much time.

Interviewee 5, functioned as an instructor during the implementation of EMR. Extra funds are allocated to buy out the instructors are from their regular clinical tasks to instruct different divisions at the hospitals in EMR. They attend a longer course and help out during the implementation. The instructors have helped out and developed functionality in EMR. During the instructor course, some of the instructors came with feedback on changes that had to be made in order to for the EMR work at their clinic. This could be changes that were specific for their division, which the producer and the South-Eastern Norway Regional Health Authority R&D division did not know of. Interviewee 5 explained the benefits of premade forms this way:

> There are premade forms that save us from keystrokes and frustration. Several of our patients receive a package of medication that is mutual for everyone, but differ dose. Although, it is supposed to be given at the same time and diluted in the same amount of water. Instead of having to put in every medication every time, we made premade forms. For example, a medication that is called "Busulfan" is given intravenous and diluted in saltwater. Instead of having to write that every time, you can just press a button and then it is activated.

Table 4
Overview of positive associations related to EMR

Advantages	**Summary**
Easy to use	Several of my interviewees say that the EMR is easy to use, once you have learnt it. They find it easy to report medication and sign for it. However, they stress the importance of experience.
Continuous documentation of medication	All interviewees perceive Continuous documentation of medication

	as one of the biggest advantages with using the EMR. Thorough documentation contributes to better quality, safety and decision support.
Accessibility	All interviewees say that accessibility is a great advantage. The EMR is accessible from all computers or at home. Earlier, much time was spent looking for curves or the doctor who last had used the paper curve.
Traceability	Traceability is also seen as beneficial. Tracking mistakes, and tracking who did the mistake is easy. However, one informant sees this as stalking and feels controlled.
Potential spin-off effects	The EMR can produce quality data for research causes, quality leadership and administrative needs.
Premade forms and standard medical packages	Instead of writing down all medication, the user can choose from premade standard treatment forms, which in turn saves the clinicians for much time.

5.1.2 Challenges associated with EMR

I asked the interviewees specifically what they perceived as disadvantages with ERM. In some interviews, I did not have to ask specifically, as challenges presented themselves as important themes for the interviewees. A common reflection among the interviewees was that the implementation process was challenging due to timing of the implementation, which was during the holidays when several employees were on holiday. Others said that is was a challenge because the EMR changed their working routines. Moreover, some interviewees said that the EMR is a comprehensive system compared to the paper records, and took a lot of effort to learn. However, the most perceived challenge or that the interviewees expresses was associated with EMR was related to the lack and absence of interaction between existing systems. Moreover, some interviewees expressed that the user-surface was a challenge.

As described in chapter 4, EMR is supposed to contribute to better patient security and quality. However, interviewee 7 and 8 actually perceive the EMR as less safe to use compared to the paper records. The following quotes illustrates the striking perceptions. “There are so many chances of making mistakes. I see several of them as dangerous. The paper records were a lot safer, because you had a decent visual overview of the medication. Now, it is unclear and messy” (interviewee, 8). Moreover, interviewee 8 expresses that the

system often crashes and you have to lo-on to the system over again. This is also obvious during the two observations, that it not only takes time to log on to the system, but it also happens that the system has to be started over again. Interviewee 8 experiences that it is difficult to do decent and efficient rounds, compared to when paper records were in use. Interviewee 7 also has a different opinion compared to the majority of interviewees:

> No, it is not safer. I actually believe that it makes the nurses dumber. You stop thinking. That is actually a problem. I have worked for many years, and can tell. With the EMR, people look at the dosage, but they forget to actually evaluate what they are going to do. It is possible that the doctors have made mistakes in the medical list. It has actually happened (interviewee, 7).

Lack of interaction with existing systems

There are several ICT-systems in use at the hospital. However, these systems have different in-logging systems, and it was obvious from observation and the interviews that these systems take a few minutes to start-up. Moreover, another issue that the interviewees stress is that it is not possible to minimize the program window. The user can therefore not see EMR in relation to for example the electronic patient record (EPR). EPR is delivered to the hospital through a different supplier than EMR. It is possible to collect data from EMR to the other the EPR, but it is not possible the other way around. As interviewee 2 states:

> There are challenges when it comes to what is supposed to register in EMR and what should be registered in EPR. Because in many cases, we want information to be registered in both systems. There are some interactions between the systems, but not enough. There is important information that we have to register in both systems. For example; the patients ID, birth number, address, what clinic they are staying at. That is rather new, because if the patient is moved from a clinic to the operating theatre, then the EMR has to be in EPR for the EMR to come along. Earlier, when we had paper records, it was just the paper that followed the patient (interviewee 2).

Interviewee 7 elaborates and exemplifies how a serious deviation once occurred, where DIPS did not interact with EMR. As a result, EMR showed the medication that was given the week before. Interviewee 7 tried to solve this by firstly calling the doctor who was responsible for this patient's medical record, then checking another computer and then DIPS. Whereas, the wrong medical record was on every platform. Interviewee 7 then called "user-support", who had to refresh and start the systems over again. The following quote described the situation:

> I spent one hour. It was a waste of time. For the systems to synchronize, you can't open DIPS before EMR. There are around 15 nurses within one hours who need to use EMR on the computer. It is obvious that you can wait 3 minutes for DIPS to open, and then wait 4 minutes for EMR to open and then collect the medication that your patient is supposed to receive. We are 12 nurses, and we have 2 computers. It is madness (Interviewee, 7).

> There are challenges when it comes to logging into the system. Because there are different in-logging systems for each system that we use. It takes time, and I believe that there should be focus on the patients, not a system that isn't working (interviewee 4)

Moreover, it come forth that it is not possible to open EMR before EPR. In order for EMR to synchronize with EPR, EPR has to be opened before EMR. Furthermore, some of the interviewees explained that the EMR share several tasks with already existing systems that they use, and they therefore often duplicate their work.

> If you don't want to double the work, there has to be an interaction that doesn't exist yet. For example, if the patient is in narcosis, you have to clock the exact time that the surgeon begins to cut, the time the surgeon is done, and the exact time when the patient wakes up. All of these times has to be registered in both EMR and EPR. It

> seems pointless and it takes plenty of time. And the times that are registered are different, because it is not possible to do it at the same time" (Interviewee 2)

The interviewees explain how EMR does not always synchronize with the other ICT systems, and that they always have to make sure that they are working with the same patient in different systems. They do not always synchronize, and it takes up to 3-4 minutes for it to do so. As a result, there is potential for making mistakes. For example, importing medication from EMR to EPR, where it has happened that the medication has a different which can have serious consequences if it is unnoticed. EMR only handles one stay at a time. This means that when the patient is hospitalized, one EMR is created, and expires when the patient is discharged. If the patient comes back, a new EMR is created. Controversy, EPR is always accessible and manages several hospitalizations at the same time, for example psychiatry and somatic. Since EMR only handles one stay at the time, there have been difficulties related to patients who move between divisions at the hospital.

Refresh-times and intensive unit-care

EMR refreshes itself several times every minute. This leads to the user to be blocked from making changes and is perceived as lag. If the user selects a medication, EMR saves and refreshes. However, the few seconds where EMR refreshes, is perceived as a lag and is enough to create frustration among the users. Interviewee 7 discusses the system`s use for his/her specific clinic this way:

> The system is not necessary as well developed for clinics where the patient has long-lasting visits. I would say that it works better for divisions where the patient stays for a shorter time. At out division, we have patients that are hospitalized over time. We have complicated medical regimes, large amounts of intravenous that have to come in order. Everything has to be put in at set times. If you are to give three medicaments, there is no room for that in the EMR (Interviewee, 7).

As of now it is difficult to use EMR on children and policlinic patients. Policlinic activities often require planning days ahead, because there is limited time per patient. Therefore. it is beneficial to make the ordinations the day before. Children have special needs and as of now there are crucial prescription forms that are missing. Interviewee 9 illustrates this point well:

" A good example is the liquid balance. If an adult receives 10 mL too much, then it is not that big of a deal. However, if a child receives 10 mL too much, the potential consequences are a whole lot worse"

5.1.3 Overview of challenges associated with the ERM

Here follows a table that summarises the perceived challenges with implantation of the EMR.

Table 5
Overview of perceived challenges associated with EMR

Weakness	Summary
Lack of interaction between existing systems	All informants perceive lack of adequate interaction between EMR and the existing systems as a large barrier. The system does not adequately synchronize with the EMR. Data can be gathered from other systems into EMR, but not the other way around. Some of the interviewees stress that the EMR and the other systems have several similar functions, and duplication of work therefore occurs.
User-surface	There appears to be different opinions about how user friendly the EMR is. However, according to 4 of my informants, the user-surface is confusing and not intuitively understandable. It is described as difficult to follow due to countless tabs that you have to click through.
Better developed for intensive care-unit	Due to missing ordination forms and design, EMR works better for intensive care-units.
Not possible to make local or personal adjustment	The interviewees emphasis that the ability to make personal or local adjustments is important and beneficial, because this can save them time and give them the ability to tailor it after their special needs. However, as of now it is not possible to make any personal or local adjustments in the ERM.

Slow	According to my informants and my observations, metavision is very slow. This is a result of lack of server capacity, technical bugs and refresh times.
Rigid	Compared to the paper-curve where the user could write what they wanted, the EMR only accepts the accurate ordination and precision.

5.2 Discussion research question one

In this chapter I have presented empirical data relevant for research question 1: "What are the perceived advantages and challenges related to EMR?". Because the EMR software is slow, rigid and does not interact with the other existing ICT systems there is frustration among the users. The empirical findings reveal that the users find the EMR as an ICT that is easy to use, that is beneficial as it is accessible from all computers, that there is potential for spin-off effects. Moreover, it comes forth that is traceable and that much times is spent due to the premade medical packages that can be created in the EMR software. In addition to Continuous documentation of medication

The most prominent perceived challenges are related to the lack of interaction between ICT systems, as they do not synchronize and works very slow. Also, the EMRs user-surface comes forth as a perceived challenge among the majority of the interviewees, as there are unnecessary many steps and clicks required to use the EMR. Moreover, it comes forth that since the EMR was originally made for intensive unit care, where patients are shortly hospitalised the EMR does not work as well for other clinics. It especially difficult to use EMR for policlinic patients, because it is not possible to make an EMR for a patient before it is hospitalised. The interviewees stress that for policlinic patients, it is best to make the EMR before the patient arrives, because it saves much time as the patient might only be at the hospital to received medication for a few hours. However, this is not possible as it is not possible to prepare an EMR before the patient is hospitalised. Moreover, it comes forth that the users desire that the EMR worked faster and that it was possible to make personal adjustments in the EMR Software. These findings coincide well with the challenges that are presented in "Dagens Medisin" (2019) and "Overlegen" (3-2019).

6 Research question two: How do hospitals work with feedback and improvements of ICTs?

In chapter 5, I discussed the advantages and challenges that the clinicians experienced using EMR. In this chapter, I will explore the research question: "How do hospitals work with feedback and improvements of ICTs?". Although my interviewees provide a number of insights, this chapter should not be regarded as a complete overview of the feedback and improvement routines that exists at hospitals. However, it is an attempt to outline some of the most important feedback and improvement routines that occurs in hospitals. In this chapter I will employ the "hospital context" definition of innovation as described chapter 2, to argue how clinicians and R&D departments contribute to incremental innovations. Moreover, I will use the evolutionary perspective and recursive approach of the innovation process as outlined and described in the theoretical chapter. In this chapter, I elaborate how ICTs often need local adjustments and adaptations. Then, I present the empirical findings related to feedback mechanisms. Next, I explore how feedback and reported issues or improvement suggestions often may result in incremental innovation. Furthermore, I describe the feedback and improvement system. Lastly, I discuss the empirical findings and how these might coincide with the theoretical framework.

6.1 Feedback mechanisms found among the clinicians

The saying "One size fits all" is used as a description of a product that would be suitable for everyone or every purpose (Cambridge Dictionary, 2019). However, it is rare that one product fits in all instances, and ICTs are a good example of a product that definitely does not fit for every purpose. Every clinic at a hospital have different procedures, medication, treatments, routines, knowledge and culture that are specific for their specialisation. Also, the clinics have different types of patients, who individually have specific needs. Consequently, clinics have different needs and require different functions from ICTs. There may for example be measurements that are substantial at one clinic, whereas they might not use it at all at another clinic. Developing one shared ICT that is suitable and adequate for every clinic, user and patient is therefore a comprehensive and recursive process. As the next pages will

reveal, developing an ICT is a recursive process that includes users, internal and external R&D departments, and the producer.

As described in the theoretical chapter, ICTs develop in a recursive way, and need considerable adaptation, substantial feedback from users and significant post-implementation development (Thune et al., 2016). In this section, I will therefore investigate the feedback mechanisms that the users of EMR initiate. During the interviews, I asked what the interviewees perceived as challenges with EMR, then what they did to meet and handle these. Some of the interviewees elaborated how there were deficiencies and how they actively reported improvement suggestions or errors. However, in some interviews I had to ask specifically if they did give feedback as reporting did not present itself as an important theme for some interviewees. Even though reporting improvement suggestions or deviations may seem like a simple task, it comes forth that some clinicians don't always find time to do so during their shift, are not motivated to do so or tend to forget to do it. Instead, they sometimes figure out new ways to use it, as will be exemplified in chapter 7. Interviewee 5 says that there indeed is reported deviations and improvement suggestions from users. However, it appears that it varies across functions:

> Every user can report defects or improvement suggestions. But, there are not that many who do. There are especially very few doctors who spend time reporting issues. Although, as an instructor I have at least sent 50 messages to the external partner about things that need to be fixed (interviewee, 5).

While interviewee 7 states:

> No one really has the time. One day can be very hectic and another can be slow. You don't have the time to sit down and wonder: "how am I supposed to do this?". No one spends time on such (Interviewee, 7).

Interviewee 6, who functions as a super-user says that they encourage everyone to report deviations or improvement suggestions. However, Interviewee 6 shares the same experience

as the majority of the interviewees and explains that they often don't find time to do so. But, adds that they inform the administration, who later on reports it to the external R&D department. However, it comes forth during the interviews and is obvious based on observations that logging on to the computer and the different ICT systems takes time. The times that the users spend on waiting for the systems to start and synchronize, contributes to frustration, and less motivation to give feedback or report deviations. As interviewee 7 states:

> We have a system that is not customized for us. So, in order for us to be able to use it, we have to report all deviations. The easiest is to report it to "Achilles". That is our deviation system. Of course, we have to log in and wait for that system to start too. It takes time.

The users find it easy to report feedback, improvement suggestions and deviations. However, during a shift there is not always time to do so. Moreover, it takes much time to wait for the ICT systems to start and in return there not much time to report issues, because the users most important task is to treat patients.

6.2 From feedback to improvement

As explored in section 6.1, the interviewees express that they do give feedback, but it is limited due to lack of spare time. In this section I will therefore investigate and discuss what the initiated feedback mechanisms contribute to. The data material points again to the issue and need of local adaption: "I noticed quite early in the course, that it would be difficult to use EMR at our division" (Interviewee, 5). Interviewee 5, also elaborated how it became obvious during the course how the standard edition of EMR would be difficult to use in their division. Hence, considerable changes needed to be made in the EMR system.
Moreover, the empirical findings show how significant adjustments were crucial to be handled before the implementation process. The adjustments and improvements that interviewee 5 refers to, are made by the internal and external R&D department in cooperation with the instructors. Whereas more comprehensive adjustments have to be made by the producers. Interviewee 9, elaborates how the improvements suggestions are handled:

> We have regional working teams, where we discuss the improvement suggestions are evaluated and discuss it is relevant for the other hospitals within the region. There are working teams for the different clinics, where we discuss things that are too advanced for the local group to solve (Interviewee, 9)

The interviewees were asked to exemplify some of the changes that were made in the EMR software both before and after the implementation. It came forth that there were important medications that were missing in the database, which was put in the software after the implementation. Also, the interviewees described how there were made premade medical packages that are customized for each clinic. This improvement was made in order to save the clinicians a lot of time. Interviewee 5 stresses that much time was spent on substantial adjustments; however, it was not until shortly after the implementation that it was ready. Interviewee 6, describes it this way: "We have reported quite a few issues. Especially medicaments that were not in Metavision. We have also reported a need for a continuously analgesia pump. In addition, we have reported in some improvement suggestions. Several of them are fulfilled"

Furthermore, the interviewees express that they often report and give feedback to the internal and external R&D departments. While, the R&D departments passes on the comprehensive and complex deviations and improvement suggestions to the producer, IMDsoft. IMDsoft, launches an updated edition of EMR every 6 months. Smaller and less radical changes like new medication, is launched by the internal R&D department every 6 weeks. The interviewees say that there are often made small improvements, and that the reported wishes or critical bugs are rather quickly handled. As interviewee 3 elaborates: "There are often small adjustments, or updates. However, when it comes to larger improvements and how our system works together with the other ICT-system, there are not made any significant improvements" (Interviewee, 3). The small improvements that are related to EMR reveals that there are frequently incremental innovations. This seems to resonate well with the ideas found in the hospital innovation literature as mentioned in the theoretical chapter, where medical innovations require substantial feedback from users and significant post-implementation development (Thune et al., 2016). Moreover, this indicates that EMR is

under continuously change due to feedback from the users. The deviations and improvement suggestions that are reported are a result of the users having problems in solving their daily tasks. This indicates that the users learn by using EMR, and in turn interact with others to fix it. Likewise, this indicates that there is a doing, using and interaction mode of innovation.

Interviewee 4, 5 and 9 shares the same perception and elaborate how it is clinicians who report what needs they have. For example, prescription forms and scoresheets that the clinicians have. However, they stress the importance of the difficulty of a standardised EMR. As interviewee 4 elaborates:

> Actually, it is reported several deviations. There are defects and quite a few things have been fixed. However, it is not measured. But, I believe that this is the methodology to put a system in work in the long run. It may be that we have different needs and see a problem more often than another division. If we don't find the system adequately, we have to report it. But that is the challenge in the other end, for those who are the developers of Metavision to find a solution that is suitable for everyone (interviewee, 4).

Interviewee 5 expresses how feedback and reported issues are taken care of and often fixed in after a short period of time:

> Things are quickly handled. I don't know if it is because I am the one who talks to them, or if that is the way the progress works. They have answered the issues and passed on the things that we have seen as critical. Several times there have been critical bugs that have to be fixed (Informant, 5).

The empirical findings indicate that feedback and improvements are two depending factors. The users initiate actively feedback, which in turn contributes to improvements. These improvements can be seen as incremental innovations, as described in the theoretical chapter. It comes forth that the feedback is handled rather quickly, but as the following section reveals the feedback system is not always used right. In addition, important information related to improvements and software updates does not always reach out to all users. The following section will therefore discuss the hospitals organisational structure. As described in the theoretical chapter, hospitals are large and complex organisations. Which is seen as a barrier to innovation, because there are many employees, professions, strategies, processes, locations, restrictions and rules. It is often underestimated how difficult it can be to communicate to the whole organisations, and how difficult it can be for the employees to communicate with the people in charge of innovation and implementation of new ICTs. Therefore, organisational structure is very important to take in consideration when implementing an ICT.

6.3 Organisational structure

As explained in the theoretical chapter, an organisations organisational structure affects the organisations propensity to innovate (Lam, 2005). It is important to consider the organisations structure as it can either foster or inhibit innovation. The interviewees elaborate how improvement suggestions or critical bugs are sent to both the internal and external R&D department. However, there has been changes during the implementation process related to who handles the different reports, who evaluates them and who is in charge of fixing them. In the early phase of the implementation process, it was the internal R&D partner who was in charge of all reports and issues. Later on, the whole responsibility was passed on to the external R&D partner. The external partner handles all of the messages that are sent in, very often these messages are passed on to the internal R&D partner. It is therefore a three-fold arrangement and cooperation between the hospital, the internal partner and external partner. The internal R&D partner say that they have informal communication with clinicians who report issues or improvement suggestions. This is because clinicians often have problems that need to be fixed right away, and they therefore receive help faster if they call the internal partner. Often, issues that are reported to the external partner need to be fixed by the internal partner anyways. However, the clinicians find it unclear who has the ability to fix what. As interviewee 9 states:

> Improvement suggestions are actually supposed to be reported to the external partner. However, these suggestions come to back to us again. We are the ones who deal with adjustments. The users don't always know if it is defects or improvement suggestions that they are reporting. We have chosen this arrangement, so that one place receives all the reports and messages. Defects or deviations is another system. Sometimes the deviation system is used the wrong way. The clinicians report things to us that might be a deviation, but should be sent to the external partner (Interviewee 9).

The empirical findings show that reported issues or improvement suggestions are evaluated, and subsequently gone through by the external partner. Furthermore, improvement suggestions are evaluated by the internal R&D partner and the other health enterprises within the same region, as the potential adjustments are mutual for these hospitals. As interviewee 5 elaborates: "We report from the hospital, and our improvement suggestions are evaluated in a small evaluation group. They evaluate many small and some bigger cases. New medication, doses and things like that. They have around 4-500 cases a year". As the empirical findings reveal, some of the users use the feedback system wrong and report directly to the internal R&D partner instead of the external R&D partner. (more context). Nonetheless, a majority of the interviewees elaborate how the internal R&D partner was present during the first days of the implementation and how feedback at that time was reported directly to them. As interviewee 5 described:

> In the transitional stage, we communicated directly with the internal partner. We just reported to those who were present during the implementation phase. I was excused from my regular job, and was responsible for helping everyone who was using EMR for the first time. I had to make sure that they were able to log-in and that it worked. That was the implementation phase that we had. In this period, we had daily meetings concerning bugs and things like that. At that time, we took things directly. After this, it was the external partner who was responsible for all reports and inquiries. So now,

> the external partner passes these on to the internal partner and the producer. It is a reasonable arrangement. (Interviewee 5)

Interviewee 11, takes part in solving simple technical issues in clinics, but informs that it actually is the external R&D departments responsibility to do the configuring. However, interviewee 11 expresses that the external R&D partner is never physically present in the clinics to assist, which makes it more challenging.

> It is challenging for me to be out in the clinics, because they often need help and I can't help them, because it is the external partner who is able to do the configuring in the EMR. I know very well how to do it, but it is restrictive and reasons for why it is like that. But, if I had the admission I could fix thing a lot faster. Often when you call the external partner, you have to wait several minutes before you come in touch with help and very often then don't have a single clue. That is an issue, when clinicians call the external R&D department for help, and then they call us right after because the external partner did not know. It becomes a messy three-fold arrangement. It is unclear for the users who is responsible for what and what equipment (Interviewee, 11)

The empirical findings that are presented above reveals that there have been changes in the feedback and improvement system. In the earlier stages of the implementation of EMR at the hospital, it was the internal R&D department who was in charge of bugs, improvements and other technical challenges. After the implementation phase, the internal R&D partner moves on to other clinics to implement EMR. Therefore, it is the external R&D department who handles bugs and improvement reports. Moreover, many of the reported improvement suggestions are passed forward to the internal R&D partner. As a result, some of the users do not know who to contact for help, or who to give feedback to. Because the internal R&D partner is present in the clinics during the implementing phase, users often contact them directly for help. However, the internal R&D partner does not always have access to help out, because it is the external R&D partners responsibility. Also, since the external R&D partner

is external and not employed at the hospital, which the internal R&D partner is, it takes more time for bugs or technical issues to be fixed. It is therefore important to consider the organisational structure as a barrier to the implementation of EMR. As the empirical findings reveal, the implementation of EMR is arranged in a three-fold way, where the intendent roles and responsibilities seems to be to be somewhat disorganized. It comes forth that the users find this arrangement frustrating, as it is challenging to come in touch with the right person who can help fix bugs or help out with technical assistance. Also, the arrangement causes frustration among the employees at internal R&D partner, because they are often contacted first as they are part of the hospital and the users are familiar with them. However, the internal R&D partner can't help because they do not have access to help, even though they know how to. The arrangement and organisational structure is therefore discussed in the following section.

6.4 Discussion research question 2

In this chapter I have presented empirical findings relevant for research question two. In the remainder of this chapter, I will discuss and analyse the empirical findings in light of the theoretical framework presented earlier. Before conducting the interviews, I assumed that there were local adjustments or adaptations in the EMR system. These adjustments might have originated from the implementation process and the subsequent feedback from users. This was also the case and as revealed in the empirical findings, the EMR did need local adjustments and adaptations before it could be implemented in the different clinics at the hospital. As interviewee 5 described, there were many medications, functions and crucial equipment that were missing in the EMR software. These particular findings are thus in line with the predictions from the applied theoretical framework.

As described in chapter 2, Petrakaki & Klecun (2015) and Pollock et al., (2003) have studied how the Electronic Patient Record (EPR) required local adaptations and adjustments in order to be fully adopted. Pollock et al., (2003), says that the suppliers aim is to make their ICT solution suitable into as many different settings as possible and that ICT software often is designed to a market, not a client. However, this is a challenge because ICT system does not easily translate across boundaries. Pollock et al., (2003), further discusses how it can be very difficult to adopt ICTs fully, because it is challenging to translate standardized software in to a new setting. Software applications that ICTs have are therefore often constructed by

adapting existing packages to new organisational context and settings. Lastly, Pollock et al., (2003) stresses that few large-scale information systems are developed from scratch. As described in chapter 4, the EMR was originally made for intensive care units where patients stay for a short period of time compared to other clinics. Therefore, the EMR software was not customised for the diverse types of hospital clinics that exists. As a result, and as the empirical findings show, it was crucial that the R&D departments in cooperation with the users developed, configured and adjusted the EMR software so that it would function and could be used in their clinic. It comes forth that there were medication and important equipment that was missing, and that there were made premedical packages. Moreover, it comes forth that critical bugs have been removed or fixed quickly. However, more advanced configuration has to be made by the producer in Israel, as the ability to adjust the software is somewhat limited. This finding coincides well with Petrakaki & Klecun (2014), who discusses how ICT software often is difficult to customise as there are some restrictions and standardisations in the software that cannot be changed. Also, this may help explain why it is challenging for the EMR to interact with the other ICT systems. This type of customisation may therefore possibly only be made by the producer. Also, the producer IMDsoft provides shared EMR software to several countries that all have different ICTs systems that need to interact with each other too. This indicates that creating a good interaction between EMR and the other ICT systems might be impossible. However, it might need a large-scale interaction program.

Smaller improvements and adjustments are as the empirical results reveal possible to be made by the internal and external R&D department. Considerable feedback from the users that the EMR require, has contributed to development and improvement after the implementation. Feedback from the users has in many cases resulted in improvements and regularly software updates. These improvements coincide well with the definition of incremental innovation. The incremental innovation definition says that innovation is: “a series of small improvements to an existing product” (Tidd et al., 2016). There are have been improvements related to premade medical packages, missing medication and equipment. These small improvements can be seen as incremental innovation, that together make a significant difference and crucial improvement of the EMR. This finding is in line with findings from Metcalfe et al., (2005), who argues that innovation in medicine is a process that is distributed across time, space and epistemic and institutional domains, which entails effort from creative

individual as well as the correlated understanding among agents. Additionally, Metcalfe et al., (2005) states that with all innovations, the acceptance of medical innovations depends on a sequence of post-innovation improvements.

The empirical findings also reveal that many of the clinicians contribute to user-innovation, as they actively report feedback, improvement suggestions and deviations. The users come up with suggestions for improvement and report these. This indicates that experimental practice and use of the EMR contributes to new idea generation, as a result of seeing potential in how EMR could work better for them. However, there is lack of time during a shift to solve issues related to ICTs. Based on the interviewees it appears that giving feedback, and reporting deviations depend on the users own motivation and interest.

The improvements that are made and the updates that regularly are released, is a result of feedback and reporting initiated from the users. Users have played and still play a crucial and considerable role in developing and adjusting the EMR. Incremental innovations result from user innovation. As described in chapter 2, literature related to user-innovation states that the phenomenon user-innovation is underestimated, as is often tacit and a result of users solving daily activities (Bradonjic et al., 2019). This coincides well with the empirical findings that are presented in this chapter. According to Lundvall (1985), the actual participation of end-users may be underrated in the innovation literature. Workers play an important part in the daily learning process taking place in production and many incremental innovations may be the product of skills workers improvements (Lundvall, 2016). Interviewee 5 described how it was obvious that there were crucial functions that were missing for it to be adopted and successful in their clinic. However, as interviewee 4 says it is difficult for the producer in the other end to make an ICT and see the specific needs. This finding is in line with the user-producer interaction theory that is described in chapter 2.

An interesting finding is that only 3 of the 11 interviewees acknowledged feedback and suggestions for improvement as a contribution to improving EMR, as this presented itself as important themes for these interviewees. Interviewee 5 stated that users contributed to development of EMR and that there were no rewarding or benefits for them, other than it being functional at their clinic. While the interviewees from the internal R&D partner said that development of EMR was driven by the users. This empirical finding reveals that user-

innovation is somewhat underestimated, while at the same time acknowledged by those who are have played significant and participant role during the implementation. In this case, the empirical findings show that the instructors and the internal R&D partner have been crucial to succeed with implementing EMR.

Before conducting the interviews, I thought that I would discover and gain a better understanding of the interaction between the users and producers of the EMR. I had predicted that there was a distance between user and producer, since IDMsoft is based in Israel. I predicted that this distance was a barrier in implementing EMR. However, the interaction between the users and producers did not present itself as an important theme for the interviewees in this study. However, the interaction between the users and the internal and external R&D departments came forth as an important theme for the interviewees.
The interviewees did not know much about the producer when I specifically asked questions related to internal and external partners who took part in the implementation process.

As revealed in the empirical findings, the organisational structure and system for feedback and improvement, is somewhat complex. This finding is in line with Mintzbergs description of professional bureaucracies, which is a typical organisational structure for hospitals and universities (Mintzberg in Lam, 2005). As described in the theoretical chapter, the appropriate organisational structures may foster innovation and knowledge production, whereas an inappropriate structure may obstruct innovation. To succeed with innovation, organisations require a structure that has the capacity to manage information-intensive work flows. Mintzberg states that bureaucratic structures work well in environments that are rather stable, however they are not seen as innovative nor do they have the ability to cope with novelty or change. Mintzberg describes professional bureaucracies as organisations with a decentralized mechanistic form, where individual professionals have great autonomy. The individual experts can be highly innovative, still it can be difficult to coordinate across functions and disciplines. Moreover, this may impose limits on the organisations innovative capability. In the case of the EMR, it comes forth that the implementation of the EMR is a decision made by the hospital board. This decision challenges the clinician's autonomy, as they are forced to use the EMR as a tool in their daily work activities. Furthermore, this structural form it is characterized as an organization where there are many individual experts, who might be innovative but who are restricted because of difficulties of coordination across

functions and disciplines (Mintzberg in Lam, 2005). On the other hand, several studies point to the fact that hospitals are actually highly innovative organisations. However, they stress the fact that it is underestimated and in some cases unrecognized (Djellal & Gallouj, 2005; Salge & Vera, 2009). As we know from theory and that the empirics in this thesis show, hospitals are large and complex organisations and the feedback system may not foster innovation or be the arranged the best way to fully exploit the possibility for improvement. It seems that it is underestimated how difficult it can be to communicate and share information across such complex organisations, as there are so many employees, clinics, functions and departments. Based on the empirical findings it is clear that the clinicians find it unclears of who is in charge of; making the changes, fixing bugs. Also, the users stress that it is time-consuming to reach the right person when they need help. Moreover, it comes forth that the interviewees don't reach out to them when they need help, because the people in the other end cannot help them, they need to reach out to someone else and set them in contact with someone else. This requires a lot of time. This leads to workarounds and ad-hoc interactions between colleagues instead of using the more structured feedback system. This will further be elaborated and analysed in chapter 7.

An interesting finding is that the existing feedback arrangement has been made in order to make the structure clearer and the responsibility areas more specific, where it is the external R&D partner who is supposed to handle all reported issues. This seems like a sensible arrangement; however, the empirical findings indicate the opposite. As the external partner, rarely is present in the clinics, and not much involved at the hospital it seems as they are dissociated to the EMR compared to the internal R&D partner. It is clear that this arrangement contributes to frustration as it is perceived as unstructured, and that it consequently makes it difficult to fully exploit the EMR benefits.

Table 6

Overview of existing feedback and improvement routines

Feedback	Improvement
The empirical findings indicate that it is unclear for the users who's responsibility or in charge of feedback It comes forth that when users are in need of help, it is often difficult to get in touch with the right person. Moreover, users do not always find the time during their shift to report deviations or improvement suggestions	The empirical findings reveal that feedback from users often contribute to incremental improvements. Adjustments and improvements of a more advanced character, needs to be made by the producer.

Table 7

Overview of feedback system

Producer, IMDsoft →	
Internal & external partner →	Reports feedback from end-users to the producer
Hospital (end-users)	Reports to internal and external R&D partner

7 Research question 3: Why is a synergy of the DUI and STI mode crucial during an ICT implementation process?

In chapter 6, I explored existing feedback and improvement routines for ICT implementation in a hospital. A main point taken from the previous discussion is that the user plays a crucial role related to feedback, while the R&D partner is essential for improving the EMR. A relevant question to ask based on this and the theories outlined in the theory chapter is therefore: "Why is a synergy of the DUI and STI mode crucial during an ICT implementation process?". In this chapter I will explore the importance of interacting innovation modes in an implementation process, as interaction between learning in practice and learning in research have been proven crucial for innovation. The applied definition of DUI and STI mode of innovation for the analysis and discussion in this chapter is outlined in the theoretical chapter. This chapter starts with studying the empirical findings that indicate that there is a DUI-mode and STI-mode of innovation. Next, I study how the organisational structure and routines for knowledge sharing affect the interaction between users and R&D partners. A large and complex organisational structure may hinder learning opportunities and information flow, which makes it difficult to fully exploit new ICTs. Then, I argue that considerable support and educational courses are important both pre and post ICT implementation. Finally, I discuss the empirical findings in light of the theoretical framework.

7.1 Role of DUI & STI in the implementation process

As described in the theoretical chapter, researchers suggest two ideal modes of innovation: Science-based innovativeness (STI) and practice-based innovativeness (DUI). Before conducting the interviews, I did not use the two ideal learning mode of innovation in the theoretical framework, and I did not ask specifically ask questions related to DUI or STI. While transcribing the interviews, I recognised that the feedback and reporting mechanisms that result in incremental innovation, are positively an interaction of learning in everyday practices and R&D projects. Also, the internal R&D partner's role in implementing, educating, configuring and improving the EMR illustrates an STI mode of innovation.

Practice-based and science-based learning were presented as important themes during questions related to the perceptions related to using the EMR in a majority of the interviews.

7.1.1 STI- related implementation processes

The STI-mode of innovation and learning typically relies on codified technical and scientific knowledge (Jensen et al., 2007). According to Salge & Vera (2009), science-based projects are often dedicated R&D projects that consist of highly qualified members. In this section, I will therefore investigate the STI-related implementation processes related to the implementation of the EMR as it proven to be crucial to succeed with innovation (Jensen et al., 2007).

Interviewee 9 and 11 take part in the hospital´s internal R&D department, and elaborated their individual role in addition to the internal R&D partner's role related to the EMR. The internal R&D department is part of a regional project that involves all hospitals within Helse Sør-Øst. It came forth that the internal R&D partner take part in teaching users how to use the EMR and that they contribute with support in the hospital clinics. The internal R&D partner also responds and evaluates improvement suggestions. Interviewee 9 presents the internal R&D partner's role:

> I work at the internal R&D department and we are responsible for the implementation of EMR. We are a part of the regional EMR project, but we work locally at one hospital. Every health enterprise that implements EMR has their local project. Our job is to educate local instructors, who further educate their colleagues (Interviewee, 9).

Interviewee 9 explained that a typical activity for the internal R&D partner is to handle improvement suggestions that are reported by users. The internal R&D department can make configurative changes and fix bugs related to for example deviations in prescription forms. Nonetheless, the interviewees explain that bigger improvement and bugs suggestions need to be sent to the producer in Israel. As described in chapter 4, the internal R&D partner and the instructors were responsible for educating the users in EMR. These courses were held in classrooms and were based on more codified scientific knowledge. This indicates and stresses that the STI-mode has been emphasised in the implementation of the EMR.

Research shows that both STI and DUI mode of learning are important to innovative performance (Jensen et al., 2007). The next section will therefore investigate the DUI-related implementation processes.

7.1.2 DUI-related implementation processes

As described in chapter 2, the DUI-mode of innovation and learning according to Jensen et al., (2009) relies on informal processes and experience. The DUI-mode is triggered by everyday challenges that occur in daily practice such as daily work activities (Salge & Vera, 2009). As opposed to STI projects, practice-based innovation projects are often conducted informally. Therefore, it can be difficult to separate innovation and regular work activities (Salge & Vera, 2009). The DUI- related processes in the implementation of EMR are plentiful and shows that it has been of importance to succeed with the implementation.

The importance of interaction among users in the implementation process

We saw in chapter 6 that interviewee 5 played a vital role in the implementation process in the role as an instructor. Interviewee 5 elaborated that implementing EMR was difficult, and that there were many changes that had to be made before the software was being ready for use. Moreover, employees were frustrated with the app, which was obvious during the course. The frustration was related to simple processes such as logging-in and the fact that the EMR software sometimes would not open. Also, it appears that the many technical challenges occurred in the beginning of the implementation of the EMR and that much time during the course to stop the myths and fear related to EMR. Additionally, interviewee 5 revealed that many clinics have dealt with the similar struggles, and that there is interaction across functions and clinics to solve daily work activities related to EMR. The following quote illustrates this: “I actually have a few friends who work at a different clinic than me, they have contacted me and asked for help with EMR to make it work better at their division” (Interviewee, 5). This quote illustrates that informal unintended interaction has been vital in the implementation process, which indicates DUI-mode.

Interaction is an important factor in the DUI-mode, and the empirical findings presented above illustrates that interaction among users has been essential in the implementation process. Interaction has been important to calm down the frustrated users and to be able to

teach the users how to use the EMR. Also, the need for intense interaction illustrates how informal and ad-hoc interaction among users across clinics has been important to succeed with the implementation. The following section will present the empirical findings that reveal how users solve daily challenges related to the EMR.

"Workarounds" as a DUI process – doing and using.

The empirical findings indicate that users create workarounds to solve mundane challenges in daily activities, as a result of learning through doing and using the EMR. A majority of the 11 interviewees expressed that the EMR looked rather easy to user during the course, however it turned out to be more difficult to use in practice. They experienced that they had several questions and issues that aroused after using the EMR for a while. Interviewee 3 said: "it was easy to learn how to use the EMR, however to use it in practice turned out to be more difficult. Therefore, many workarounds are made in order for it to work". Interviewee 6 shared the same opinion as interviewee 3, and the explained the consequence of using workarounds as a sustaining solution.

> Yes, I think that there are many who use it wrong. Because it does not work the way we were taught in the course. The problem is that when you have had it for a while, you forget that that is not the way it is supposed to work. And then we forget to report it. We just work around it (Interviewee, 6).

Four of the interviewees said that they find new ways to solve their activities in EMR, because they don't have time to figure out how they actually are supposed to use it.

> Yes, it becomes that way. It is probably because no one has time. One day can be quiet, while another can be very hectic. We don't have time to sit down and mull over how you actually supposed to use the EMR (Interviewee, 7).

Interviewee 7 elaborated that EMR is a complex system, with numerous tabs and functions. Moreover, interviewee 6 expresses that regardless of the unnecessary tabs and functions, it was rather easy to user: "I know that there are many functions that I haven't figured out yet. But I don't need it, and I only concentrate on the functions I actually need. I'll learn the other

things after a while" (interviewee, 6). Moreover, interviewee 7 explained how some medical treatments are complicated to put in EMR and how time-consuming it is if a mistake is made in that process. As a result, it appears that they interact with each other and use paper:

> We perform double control. We can for example hold a medicament in the air, and then show it to someone who is close to a computer. Then they go in and sign for it in the EMR. Later on, we later sign ourselves. Otherwise, we write it down on paper with another nurse who is present, what we are going to give the patient and what we have given. Later on, we sign for it in EMR when we have a computer that is available. It works better that way, because it is often a rush to give the patient the medicine (interviewee, 7).

The quotes presented above shows that users in some cases find other ways to use the EMR, when they meet challenges in daily activities in the EMR. Additionally, the quotes illustrate how there is lack of time to figure out how the EMR actually is supposed to be used, because the patient needs full attention from the clinicians. As described in chapter 5, the EMR has numerous functions and tabs, but the empirical findings reveal that users learn the functions and tabs by experience over time. This illustrates the importance of learning in practice related to successfully implement the EMR.

Interviewee 7 elaborated the importance of experience with paper records in order to understand and be able to use the EMR in the best way, as it appears that EMR is a very rigid system. It comes forth that for example the exact timing for a medical treatment has to be registered in EMR at the exact right time. Therefore, interviewee 7 stresses that experience with the previous analogue paper record makes it easier to understand and use EMR, because you have better understand that the timing in EMR are made to guide the user. However, interviewee 7 perceives that many clinicians are too tied to the rigid times, and that it contributes to unnecessary stress, and loss of the overview of the patient's medications.

> If you don't have experience with the paper records, which are not so rigid when it comes to timing. Then it will be very difficult for you to use EMR alone. I believe that you need help from clinicians who have worked for 4-10 years, who can tell you that the times in EMR are guidance. But very many are obsessed with the times, and think that they need to register deviations. That causes unnecessary stress. I see this daily. They lose the total overview, which we had with the paper records (Interviewee, 7)

This quote illustrates and supports the importance of learning in practice, doing and using in order to be able to use the EMR in the best way and fully exploit its benefits. It seems to be beneficial for clinicians to have experience with the analogue paper records to better understand the EMR, however not all clinicians have this. Nevertheless, knowledge related to the analogue paper-records is codified and may possibly be gained through reading books, and supports the importance of STI-mode of learning in the implementation processes.

In this section, the empirical findings have illustrated the importance of learning in practice, indicating the DUI-related implementation processes. The users learn how to use the EMR by doing, using and interacting with other users. Additionally, users lack time to sit down and figure out how the EMR should be used. Therefore, users create workarounds, and use it in unintended ways. In the following section I will present the empirical findings that may reveal why the users in some situations struggle with using the EMR.

Lack of information flow – interacting with R&D partners

A shared perception among 10 of the 11 interviewees, is related to lack of important information about the EMR. The interviewees from the internal R&D department both elaborated that there was significant information that they did not receive from the hospital clinics before the implementation process. Interviewee 9´s perceived lack of information flow and cooperation between the internal R&D partner and the hospital clinics in the EMR project as a considerable challenge. Interviewee 11 expressed also expresses some opinions on this: "People in the clinics don't communicate and I don't receive the information. I have experienced that I have been at a clinic, and then they have decided to postpone the implementation date without informing me" (Interviewee, 11).

Interviewee 9 stated that: “The biggest challenges are that information does not reach the users. For example, we now have a new update that some might have waited for. But the users don’t always read their email and do not know” (Interviewee 9). Interviewee 3 elaborated how it is difficult for information about functionality and new updates to reach users and that it has resulted in workarounds. The following quote illustrates this:

> We received information from users that EMR not necessarily is used in the most optimal way. EMR was not used the way it was supposed to. For example, it was a bit complicated to prescribe drugs. As a result, some users chose to do this in another way, which was way more inconvenient. So, the users kept on using the EMR in a way more inconvenient way than necessary, even though the information about how to prescribe the right way was sent out to all clinics (Interviewee, 3).

The empirical findings in this section reveal that both the internal R&D partner and the users experience that important information does not come forth. The users express that there is absence of information related to new functionality and software updates, whereas the internal R&D partner elaborates how vital information related to clinics specific needs and routines are not revealed. The lack of interaction between the users and the internal R&D partner may contribute to the creation of workarounds as described in the previous section, additionally it further stresses the importance of interactions and structured routines related to information flow and a consequence of “one size does not fit all”. The empirical findings indicate that there is no assurance that considerable information related to the EMR actually reaches the users. In the following section, I will present the empirical findings related to how the users want more dedicated support from the R&D partners after the implementation. This may be a consequence of the lack of information flow and support, and shows the importance of dedicated education of a new ICT.

7.2 Continuous professional support from inception to completion

As described in the theoretical chapter, innovation processes require considerable support in both the early phases and later exploitation stages, in order to successfully adopt a new ICT.

Moreover, Salge &Vera (2009) points out that hospitals R&D departments deliver dedicated support in the early phases, whereas little attention is paid to the later stages (Salge & Vera 2009). The empirical findings in this study reveal that the users desire more support and education post the implementation. As interviewee 10 elaborates:

> The teaching and course that we had before the implementation was very good. But, we miss a follow-up. Now we have used it a while. It would be beneficial if our challenges where tracked and if the internal or external R&D partners would help us find solutions to our problems that we cannot see. We are using it now, and it works ok. But the challenges we have related to for example preparing medical records for policlinic patients, changing the timeline and the correct ordinations. We don't know how to solve them (Interviewee, 10).

Another interviewee feels that it is difficult to exploit the advantages of the EMR fully, because there is no support from the instructors after the implementation. "It is hard to exploit the benefits, because there is no course beyond the implementation" (interviewee, 6). Interviewee 11, from the internal R&D department elaborates how they play a significant role before the implementation process, but how they move on to the next clinic right after it is implemented. Nevertheless, because of close interaction with the users in the early phase, it appears that there remains an ad-hoc informal interaction between some of the users and the internal R&D department. The following quote illustrates this interaction:

> After the implementation, I go to the next division, but there remains an informal interaction. This is because I get to know the users in the division, and they call or text me without hesitating. Instead of reporting to the external partner, that later comes to us anyways. They choose to call me right away, because I can often help them right away (Interviewee, 11).

This section has illustrated that the users express a need of more education related to the use of EMR, as they have experienced challenges after the implementation. These challenges are

described in chapter 6. Moreover, the findings reveal that the users communicate informally, intendent and directly with the internal R&D partner, as a result of lack dedicated support or follow-up education as they need help to solve daily activities fast. The findings show that the users in some cases their way work around the arranged feedback system, and interact with the internal R&D partners who were present during the early phases of the implementation. This indicates that the users solve ordinary challenges in daily activities by interacting informally with the internal R&D partner, and further stresses the importance of DUI-mode to succeed with the implementation.

7.3 Discussion research question 3

In this chapter I have presented empirical findings relevant for research question 3. In the remainder of this chapter, I will discuss and analyse the empirical findings in light of the theoretical framework presented earlier. As described in the theoretical chapter, learning in practice is highlighted as an important source of ICT innovation for at least two reasons. Efficient use of new ICTs often requires development of dedicated procedures and organisational routines, and second to be able to evaluate if an ICT works as anticipated, the actual strength and weaknesses are revealed by being used (Consolie et al., 2016; Jensen et al., 2007). Research has shown that a synergy between the two ideal modes of innovation and learning is beneficial for innovation (Jensen et al., 2007; Apanasovich et al., 2016). The findings that are presented in this chapter may not be applicable for all hospitals and clinics within Helse Sør-Øst, but shows an example of how DUI processes are vital in order to introduce new organisational practices in a hospital environment.

The STI-related implementation processes in this study were related to how the internal R&D partner works with improvement and configuration of the EMR and how they educate and course the users in the EMR. The internal R&D partner is a project-based team, consisting of a group of expertise employees, who works fulltime with the implementation of the EMR. In order to do the configuration and improvements in the EMR software, there is a need for codified technological and scientific knowledge such as medical knowledge and step-by-step manuals. The findings show that STI-mode of innovation is in centre of attention at the internal and external R&D partners, when it comes to providing improvement and configuration of the EMR. The observations regarding DUI and STI are based on these concepts of two ideal modes of innovation (Jensen., et al 2007; Salge & Vera 2009).

Education and coursing that the internal R&D partner is responsible for seems to be based on codified scientific and technological knowledge as it is based on classroom teaching and user-manuals. The suggestions for improvements and feedback are based on DUI-related processes.

More evidently, empirical findings in this chapter indicate that learning by doing, using and interacting is vital for implementation of new ICTs, and that users initiate this mode. As described in chapter 2 and in the beginning of this chapter, DUI-mode of innovation and learning involves learning in practice, tacit and hidden knowledge, informal, unintended and directly interaction across functions and clinics (Salge & Vera, 2009; Jensen et al., 2007). We have seen that several DUI- related processes are present in the case of the EMR implementation. First, users of the software seem to interact with each other across hospital clinics in order to solve problems in daily activities. They ask each other for help and advice through informal channels. Second, the findings show that the when the users meet challenges in EMR software they often make workarounds, as they do not have time to figure out how the EMR is supposed to work. This is a result of doing and using the EMR, and supports the fact that DUI-mode of learning is important to successfully implement the EMR (Jensen et al., 2007; Salge & Vera, 2009). Third, the interviewees stress that regardless of the numerous tabs and functions in the EMR they learn these functions after a while. Hence, doing and using the EMR over time is crucial for learning how to fully exploit the software.

Fourth, the findings presented above together with findings about feedback and improvement as elaborated in chapter 6, illustrates the importance of another part of the DUI-mode; using and learning. Improvement processes are initiated by users as they report feedback and improvement suggestions to both the internal and external R&D partner. Reporting improvement suggestions is a result of learning how things can be optimized and seeing the potential of the EMR. Reporting deviations is also a result of doing, using and realizing that the EMR is not working the way it is supposed to. As elaborated in chapter 6, feedback can result in improvements in the software and how it is used, which clearly can be regarded as user-innovation (Jong, 2014). Even though improvements and configurations are made by the R&D partners, they are initiated and driven by the user's doing, using and interacting (Jensen et al., 2007; Salge & Vera, 2009). However, as users in this case are clinicians and cannot make changes or developments in the EMR, these improvements or configurations need to be

made by the internal or external R&D partner. The fifth dui-related finding is therefore that feedback from user's needs to be uttered and shared in the organization and with the R&D partners, as they are not revealed unless the users express them. This knowledge is tacit, as it is not codified and needs to be distributed and learned through interaction, intense face-to-face communication and experience. Hence, the software is learned through DUI-mode because such knowledge is tacit in nature and you need to learn it by doing, using and interacting with it. This knowledge is not codified and illustrates the importance of DUI-mode, as a three-hour long course and a manual is not enough to learn this in a good way.

Sixth, this finding illustrates that STI and DUI are two depending factors that both are crucial to the implementation processes of the EMR, and supports the findings from Jensen et al., (2007) and the review article by Apanasovich et al., (2016). These articles stated that a synergy between STI and DUI is crucial to successful innovation. Nonetheless, it is important to mention that most research on DUI and STI concerns firms in the private sector and cases where it would be possible for users to develop products or processes, and therefore remain hidden or tacit. In case of the EMR, this is not possible as clinician's main task is to treat patients, and not develop ICT software. However, the DUI framework is still applicable for the public health sector, as the empirical findings presented in this chapter do indicate important factors of DUI- and STI- mode of innovation and learning. Salge & Vera (2009) states that DUI- and STI- processes are proven to be beneficial to hospitals performance, which indicates that it is important for many processes in hospitals in general for providing the best treatment.

The empirical findings indicate that there is a weak information flow between the users and the R&D partners, as important information related to the EMR does not reach out to the users. It comes forth that the internal R&D partner does not receive important information from the users about for special needs or issues that they have. The users express that they do not receive information related to EMR updates and improvements. The findings indicate that the interaction between users and the internal R&D partner is ad-hoc, and that there seems to few structured routines making sure that information reaches the users. These findings can be partly explained by the fact that hospitals have a complex structure with many employees. This makes it difficult for information to pass through to everyone and illustrates the importance of structured routines for information flows in hospitals (Mintzberg in Lam, 2005). This can be done by formalising the DUI-processes and making the DUI more STI, so

that it is easier to make good procedures. The lack of information on updates and improvements in the EMR may answer why workarounds are created. As a consequence of the weak information flow might be that it is difficult to exploit the EMRs benefits fully, because the users are not familiar with the updates or improvements that are available. The empirical findings showed that the interviewees perceived a need and desire for considerable support and education after the implementation. This finding indicates that even though the educational courses in EMR seems to be based on codified scientific and technological knowledge (STI), it is crucial with practice and experience-based knowledge (DUI) in order to exploit the EMR fully. My findings suggest that the absence of professional support after the implementation creates frustration and workarounds. This fact is also observed by Salge & Vera (2009). According to Salge & Vera (2009), all STI and DUI based innovation projects need professional support from implementation to completion. Salge & Vera (2009), further stresses hospital R&D departments often focus on the earlier stages, and pay little attention to the later exploration, where innovative projects require dedicated support on their way to successful internal adaptation. This supports the empirical findings in this particular case, where it is seems as if it has not be is not put adequate attention to education of users in the EMR. This may lead to duplication of work, wrong use, frustration and potential medical errors.

The desire for more education and dedicated support can partially be explained by the education and course arrangement that the internal R&D partner has offered. The empirical findings indicated that there has not been put much effort to the education and courses. The normal users attended a three-hour course, while the super-users participated in a 6-hour course. 3- 6 hours is remarkably little time to be able to learn how to use a new and comprehensive ICT system. It surprising because wrong use of EMR can severe medical errors. Due to little education and follow-up support, these findings indicate that it is the users' responsibility to learn how to use the EMR, and is dependent the user's motivation and attitude towards it. As a result of this, some users interact informally with the internal R&D partner for help with the EMR. This finding illustrates that there is ad-hoc interaction which further stress the importance of structured routines in feedback and improvements. Another consequence of adequately educational attention is that there are made workarounds and that there is frustration among users. This coincides well with article in Overlegen (3- 2019), where the director of technology and e-health in Helse Sør-Øst RHF acknowledges that they

have not dedicated enough attention to the process and educational part of the implementation of EMR, whereas they have focused on the EMR system and implementing it in all clinics. The lack of information flow as described in the previous section, between the internal R&D partner and the users may be explanatory for why there is no dedicated support or education related to the use of EMR after the implementation, as the internal R&D partner may not know that the users desire and needs it.

8 Conclusion

In this study, I have explored three research questions with the purpose of answering the overarching research question "How do hospitals learn and exploit new opportunities for innovation when implementing new ICT solutions?". In this chapter I will gather the most prominent findings from the three research questions. The implications of this study will be presented and followed by reflections of the study´s limitations. Finally, this chapter ends with presenting suggestions for future research.

8.1 Summarizing the research questions

The first research question, "What are the perceived advantages and challenges related to the EMR?" revealed that a majority of the interviewees perceived the EMR as easy to use, more accessible and traceable than the analogue paper-record. Additionally, it came forth that the perceived continuously documentation of medication, possible spin-off effects and premade forms and standard medical package as advantages of the EMR. Furthermore, research question 1 revealed that there were challenges related to lack of interaction between the EMR and the other ICTs in the hospitals ICT portfolio. Moreover, a majority of the interviewees expressed that it was challenging to use the EMR because it works slow, is more suitable for intensive unit care, not possible to make personal adjustments and because of an unfortunate user-surface. A few of the interviewees said that these challenges contributed to weaker patient rounds. An interesting development worth mentioning, and has come forth after my data collection, is that further implementation of EMR in Helse Sør-Øst has been postponed. They argue that is not safe as the new software update is to slow, not stable enough and poor performance.

The second research question, "How do hospitals work with feedback and improvement when implementing an ICT?", revealed that the EMR needed local adaptations and customisation to be successfully implemented. The findings show that the required adaptations and customisations are a result of users who actively report feedback and suggest improvements. The improvements can be defined as incremental innovations and are a result of user-innovation. User-innovation is as described in the literature often underestimated, this seems to be the case related to the EMR too. This is may be the case because it is difficult to perceive feedback and suggestions for improvements as innovations because it is not the users who make them. However, the feedback and suggested improvements are not revealed

unless the users initiate them. Another prominent finding is that it does not seem to be structured routines for feedback or improvements, as the findings reveal that they are somewhat ad-hoc. This may be because hospitals are large and complex organisations and therefore difficult to interact and communicate across functions and divisions.

The third research question, "Why is a synergy between the DUI- and STI- mode crucial during an implementation process?" revealed that the two ideal modes of innovation and learning are two depending factors in the implementation process of the EMR. It comes forth that the users learn how to use the EMR in practice by doing, using and interacting with each other. Additionally, the findings reveal that STI-mode of innovation and learning has been crucial to make configurations related to improvements and bug fixes, in addition to the educational courses in the EMR. DUI and STI are two depending factors in the implementation process of the EMR, as the clinicians learns through using the EMR what does not work and how it can work better for them, however as they are clinicians and their main task is to treat patients they are dependent on the R&D partners who use STI- related processes to configure and improve the EMR. Furthermore, this research question reveals that the user's desire more dedicated support and education in the EMR to better exploit the benefits of the EMR. However, as the findings reveal there is lack of information-flow between the users and the R&D partners, which indicates that the R&D partners may not be aware of the user's wishes. This further supports the importance of structured feedback and improvement routines.

8.2 Discussion of the overarching research question

The overarching research question in this study is "How do hospitals learn and exploit new opportunities for innovation when implementing new ICT solutions?" This research question is broad and difficult to answer with the scope of a master's thesis. Nevertheless, the aim with this thesis is to provide some insights of how hospitals implement new ICTs, and the exploitation of the related learning and innovation opportunities that such a process has. A prominent finding is that users play a crucial role in innovation in hospitals in the process of implementing an ICT. Also, this study illustrates that it is challenging to implement an ICT that is developed elsewhere and points to the importance of user-involvement. In this study, users have shown to have played a prominent role as the EMR was a slightly unfinished ICT that required adaptation and customisation to meet the users' specific needs. Users have first-

hand practical experience with the use of the EMR, which the findings indicate are essential for the development and improvement of the EMR.

This study of EMR illustrates how learning by doing, using and interaction in daily activities can lead to user-innovation in terms of incremental innovation. Furthermore, this study illustrates how it is difficult to organise a successful implementation process in a hospital, and that cooperation across clinics and functions are essential. A possible conclusion from this is that structured routines for feedback and improvement are crucial to fully exploit the opportunities for learning and innovation when implementing a new ICT in hospitals.

8.3 Limitations

This study does have limitations. First, this study only has 11 interviewees of 78 200 employees in Helse Sør-Øst. This limitation causes implication for the applicability of the empirical findings to other contexts and to the specific hospitals that are studied. To include more hospitals, the external R&D partner, more interviewees from the internal R&D partner and several clinicians from different clinic would be ideal to include to gain a deeper insight and more perspectives. As these interviewees could contribute to a greater understanding of how ICTs are implemented, improved and how the learning processes occur. Also, it could reveal if the empirical findings is observed or shared among others too. Additionally, it is also possible that this case may be of limited value for other ICTs.

8.4 Suggestions for further research

This thesis shows that implementation of ICTs is complex and challenging. More knowledge is needed to optimise the interaction between technology providers and technology users, in order to make sure that the ICT is ready for implementation in hospitals. More research is needed to understand what is vital for successful implementation. My research suggests that involving users in the development of the ICT is underemphasised. The importance of education and support seems to be vital for successful implementation, and further research on this could be useful. There is need for more research on users' involvement in developing and improving ICT's by external producers. My findings indicate that the implementation of ICTs provides opportunities for learning by doing, using and interacting. There is a need for

more research to gain deeper insight into how hospitals can improve communication and interaction to address the users need.

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Appendix

Intervjuguide (BRUKERE)

1. ***Kort om informantens bakgrunn, rolle og oppgave i forhold til elektronisk kurve***

   - Kan du fortelle litt om hva du jobber med og hvilke ansvarsområder du har?

2. ***Hvordan og hvorfor ble kurven innført***

   - Kan du fortelle litt om hvorfor dere ønsket å gå vekk fra papirkurven (Hvor kom den til kort og hvor fungerte den godt?
   - Kan du fortelle litt om hvordan den elektroniske kurven ble implementert?
   - Hvordan jobbet du/dere med implementeringen, hvem var involvert i implementeringsfasen?

3. ***Hvilke endringer, justeringer eller eventuelle forbedringer er gjort med kurven før og etter den ble implementert?***

   - Hvilke endringer har dere gjort ved kurven for at den skulle fungere og passe inn hos dere?
   - Kan du fortelle litt om hva slags utfordringer det har vært knyttet til implementeringen?
   - Hvordan løste dere disse?
   - Hvem løste de?
   - Kan du fortelle litt om hva du syntes fungerer godt ved kurven? (eksempel)
   - Kan du fortelle litt om hva du ikke syntes fungerer så godt ved den? (eksempel)

4. ***Hvilke endringer har innføringen betydd i arbeidsmåte, organisering, samarbeid?***

1. Organisasjons endringer
   - Måtte det gjøres endringer i avdelingen før implementeringen? (arbeidsfordeling, samarbeid, eller arbeidsmåte?).
   - Er det skjedd noen endringer i arbeidsmåte eller organisering etter implementeringen?

5. ***Hvilke fordeler og utfordringer har innføring innebåret?***

   Fordeler og ulemper
   - Kan du fortelle litt om hvilke fordeler du opplever som følge av kurven?

- Hvilke holdninger opplever du at de ansatte på din arbeidsplass har til kurven?
- Hva tenker du at er grunnen til at enkelte avdelinger har valgt å gå vekk fra kurven etter å ha tatt den i bruk?
- Hva anser du som ulempen eller utfordringene med kurven?
- Hvordan går du/dere frem for å møte disse utfordringene (eksempler?)?
- Hva tenker du at er årsaken(e) til at implementeringen har tatt lang tid?

Intervjuguide Internal R&D partner

1. Kort om informantens bakgrunn, rolle og oppgave i forhold til elektronisk kurve

- Kan du fortelle litt om hva du jobber med og hvilke ansvarsområder du har?
- Hvilken rolle har du hatt i forbindelse med innføring og implementering av elektronisk kurve

2. Hvordan og hvorfor ble kurven innført

- Kan du fortelle litt om hvorfor Helse Sør-Øst ønsket å gå vekk fra papirkurven (Hvor kom den til kort og hvor fungerte den godt?

- Kan du fortelle litt om hvordan den elektroniske kurven ble implementert?

- Hvordan jobber du/dere i med implementering av elektronisk kurve (hvilken rolle hadde dere som intern FOU i forhold til opplæring av superbrukere)?

- Samarbeidet dere med noen om implementeringen? (Myndigheter, andre sykehus, leverandør, produsent)?

- Ble det utført risikovurderinger av elektronisk kurve?

- Hvilken rolle har dere nå?

- Hva var det som gjorde at metavision ble valgt? (fremfor et annet, finnes det et alternativ, fra dips evt?)

3. Hvilke endringer, justeringer eller eventuelle forbedringer er gjort med kurven før og etter den ble implementert?

- Hvilke endringer har dere gjort ved kurven for at den skulle fungere og passe inn i de ulike avdelingene på dette sykehuset?
- Kan du fortelle litt om hva slags utfordringer det har vært knyttet til implementeringen av elektronisk kurve (kan du komme med eksempler på ulike utfordringer)?
- Hvordan løste dere disse?
- Hvem løste de?

4. Hvilke endringer har innføringen betydd i arbeidsmåte, organisering, samarbeid?

5. Organisasjons endringer
   - Måtte det gjøres endringer i avdelingene før implementeringen? (arbeidsfordeling, samarbeid, eller arbeidsmåte?).

- Er det skjedd noen endringer i arbeidsmåte eller organisering etter implementeringen?

6. Hvilke fordeler og utfordringer har innføring innebåret?

Fordeler og ulemper

- Kan du fortelle litt om hvilke fordeler du opplever som følge av kurven?
- Hvilke holdninger opplever du at sluttbrukeren har til kurven?
- Hva tenker du at er grunnen til at enkelte avdelinger har valgt å gå vekk fra kurven etter å ha tatt den i bruk?
- Hva anser du som ulempen eller utfordringene med kurven?
- Hvordan går du/dere frem for å møte disse utfordringene (eksempler?)?
- Hva tenker du at er årsaken(e) til at implementeringen har tatt lang tid?

Vil du delta i forskningsprosjektet

" (Drivere og barrierer for implementering av nye teknologiske løsninger)"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke hvilke drivere og barrierer det er for implementering av nye teknologier ved sykehus. I denne studien vil den elektroniske-legemiddel kurven bli brukt som case for å belyse problemstillingen. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Formålet med denne masterstudien er å studere og undersøke hvordan nye teknologiske løsninger blir implementert i en stor og kompleks organisasjon i offentlige sektor. Målet er å undersøke hva som drivere og barrierer for implementering av teknologi i sykehus. For å studere dette, vil jeg analysere bruk og implementering av elektroniske legemiddel-kurve. Formålet med studien er å kunne bidra til innovasjonslitteraturens del om innovasjon i offentligsektor og i sykehus, da dette ikke er skrevet om tidligere. Videre er formålet med studien å kunne bidra til å gjøre fremtidig implementeringsprosesser av ny teknologi enklere.

Studien er en del av en masteroppgave ved TIK på UiO.

Hvem er ansvarlig for forskningsprosjektet?
UiO, Senter for Teknologi, Innovasjon og Kultur.

Hvorfor får du spørsmål om å delta?
For å få svar på det jeg undersøker ønsker jeg et utvalg av informanter som har høy informasjonsverdi. Som forsker har jeg benyttet meg av snøball metoden for å velge ut informanter. Jeg har i den forbindelse fått kontaktopplysninger fra andre og mulige informanter.

Hva innebærer det for deg å delta?
I denne studien vil det være intervju for å samle inn data til studien. Intervjuene vil tas opp og deretter transkriberes.

- *Dersom du velger å delta, innebærer dette et intervju. Det vil ta deg ca. 35- 45 minutter.*

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- *Det er kun jeg som forsker som vil ha tilgang på dataene som samles inn.*
- *For å sikre at ingen uvedkommende får tilgang til personopplysningene, f.eks. «Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrige data», lagre datamaterialet på forskningsserver, innelåst/kryptert, etc.*

Deltakeren vil ikke kunne gjenkjennes i publikasjon.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes *[28.10.19]. Ved prosjektslutt vil personopplysninger og opptak slettes.*

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra *Universitetet i Oslo* har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
Universitetet i Oslo ved *(Erlend Simensen,* e.o.simensen@tik.uio.no)

- Vårt personvernombud: *Maren Magnus Voll* personvernombud@uio.no
- NSD – Norsk senter for forskningsdata AS, på epost (personvernombudet@nsd.no) eller telefon: 55 58 21 17.

Med vennlig hilsen

Prosjektansvarlig

Hedda Korsæth

(Erlend Simensen)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *(Drivere og barrierer for implementering av nye teknologiske løsninger ved sykehus)*, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i *(intervju)*
- ☐ å delta i *(spørreskjema)*
- ☐ *at lærer kan gi opplysninger om meg til prosjektet*
- ☐ *at mine personopplysninger behandles utenfor EU*
- ☐ *at opplysninger om meg publiseres slik at jeg kan gjenkjennes (beskriv nærmere) – hvis aktuelt*
- ☐ *at mine personopplysninger lagres etter prosjektslutt, til (beskriv formål) – hvis aktuelt*

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. *(24.10.19)*

(Signert av prosjektdeltaker, dato)

NSD sin vurdering

Skriv ut

Prosjekttittel
Implementering av nye teknologiske løsninger/ innovasjoner i norske sykehus

Referansenummer
437639

Registrert
03.12.2018 av Hedda Korsæth - heddako@student.sv.uio.no

Behandlingsansvarlig institusjon
Universitetet i Oslo / Det samfunnsvitenskapelige fakultet / Senter for teknologi, innovasjon og kultur

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)
Erlend Simensen, e.o.simensen@tik.uio.no, tlf: 46743537

Type prosjekt
Studentprosjekt, masterstudium

Kontaktinformasjon, student
Hedda Korsæth, hkorseth@hotmail.com, tlf: 99370860

Prosjektperiode
01.12.2018 - 10.10.2019

Status
24.04.2019 - Vurdert

Vurdering (2)

24.04.2019 - Vurdert
NSD har vurdert endringen registrert 22.01.2019.

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjenno

Chat med oss på hverdager fra 12-14

N

NSD Personvern
22.01.2019 10:33

Det innsendte meldeskjemaet med referansekode 437639 er nå vurdert av NSD.

Følgende vurdering er gitt:

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 22.01.2019, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD ENDRINGER
Dersom behandlingen av personopplysninger endrer seg, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. På våre nettsider informerer vi om hvilke endringer som må meldes. Vent på svar før endringer gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 24.05.2019.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke behandles til nye, uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet