eHealth development in Sweden:
A study of prominent aspects and benefits from a multi-user perspective

LUDVIG JAKOBSSON
JONATHAN SOBIN

Master of Science Thesis
Stockholm, Sweden 2014
eHälsa-utveckling i Sverige:
En studie om framträdande aspekter och fördelar utifrån ett fleranvändarperspektiv

LUDVIG JAKOBSSON
JONATHAN SOBIN

Examensarbete
Stockholm, Sverige 2014
eHealth development in Sweden:
A study of prominent aspects and benefits from a multi-user perspective

Ludvig Jakobsson
880624-1439

Jonathan Sobin
890923-0297

Master of Science Thesis INDEK 2014:43
KTH Industrial Engineering and Management
Industrial Management
SE-100 44 STOCKHOLM
eHälsa-utveckling i Sverige:
En studie om framträdande aspekter och fördelar utifrån ett fleranvändarperspektiv

Ludvig Jakobsson
880624-1439

Jonathan Sobin
890923-0297

Examensarbete INDEK 2014:43
KTH Industriell teknik och management
Industriell ekonomi och organisation
SE-100 44 STOCKHOLM
Abstract

The European health care is facing challenges with an increasing ageing population, with a higher frequency of chronic diseases, which have resulted in rising health care costs. Meanwhile, the trend shows how patients and citizens are becoming more active in their personal health care, with the number of existing doctors and nurses subsiding furthermore entailing problems. The area of eHealth, which involves information and communication technologies with health care, is hence seen as a partial long-term solution and is considered being a rapidly growing market both in Sweden, but also in Europe. eHealth services further consider to promote increased access, mobility and interoperability in the health care, but the lack of wholehearted commitment, financial support and complex EHR-systems in Sweden's municipalities and county councils might partially impeding down the development. The purpose of this report is therefore targeting to explore, identify and analyze prominent aspects for the continued development of the Swedish health care and eHealth services. The study also examines what subsequent benefits an implementation of an eHealth service entails, which also has been related to the identified prominent aspects.

This master thesis is based on a thorough literature review extracted from a theoretical framework including an interoperability-, security-, mobility- and business-modeling perspective, which are used as a foundation for the building of a set of hypotheses, which are subsequently verified with the aid of gathered empirics. The empirics are obtained from 10 semi-structured qualitative interviews, as well as two case studies, which together resulted in key-findings and conclusions.

Firstly, in relation to the interoperability perspective, it became clear how there should exist both a technical and social interoperability that communicate with each other. The EHR-systems of today are often considered difficult to learn, non-intuitive and lacking interfaces that are user-friendly designed for the end-user. Increased interoperability was also seen as enabling and simplifying the access to the patient’s medical history, which the EHR-system TakeCare evidently demonstrated. Furthermore, it was acknowledged how there is no correlation between the increased time spent by health care professionals with administrative tasks and documentation with an increased interoperability. It also emerged that patients and the dominant part of the population had either no or very limited knowledge regarding the underlying security and overall management of personal health information in health care. Patients instead often blindly trust the Swedish health care system being secure, and prioritizing other things during medical appointments. The knowledge of security issues in the health care is predicted to increase among patients if they in the future would obtain full
access to their own medical records. There is also a general opinion among health care professionals and related instances how new security risks will arise alongside the eHealth wave, with a particular concern for the increasing involvement of mobile devices. Relationships between an increased interoperability also seem to favor increased mobility in health care, but security aspects often prevent the mobility development. Finally, it was unanimously espoused how non-financial values must not be ignored, where the on-going debate argues whether what real impact these non-financial values have, where inter alia strict budgets and large gaps between the decision-makers and end-users appeared as issues. Similar arguments were encountered regarding the actual impact of the opinions of patients in relation to business modeling, where a tripartite-problem and the patients’ limited access to their medical records was partly seen as a primary issue.

Secondly, the case studies demonstrated how a transition to the EHR-system TakeCare generally did result in cost- and resource savings in terms of local servers, IT-maintenance and inventory management. The TakeCare implementation also led to an increased visibility among health care centers by enabling and simplifying the access to patient medical history. Increased communication, awareness, and more effective internal processes due to integrated modules and direct connections to ePrescriptions could also be accessed from the TakeCare transition. Finally, it emerged that relations existed between simplified access to the patient’s medical history and how it subsequently resulted in an increased interoperability. A correlation was also seen as the health care become generally more mobile due to increased interoperability.

Key-words: eHealth, e-health, business model, business modeling, Business Model Canvas, BMC, Electronic Health Record, EHR, ICT
Sammanfattning


Utifrån ett interoperabilitetsperspektiv framgick det hur det bör finnas både en teknisk och social interoperabilitet som kommunikerar med varandra, då journalsystem idag anses vara svåra att lära sig, icke intuitiva och ej användarvänligt utformade för slutanvändaren. Ökad interoperabilitet ses även möjliggöra och förenkla åtkomsten av patienthistorik, vilket journalsystemet TakeCare tydligt påvisat. Vidare kunde det konstateras att det inte finns en korrelation mellan den progressivt ökande avsatta tiden som sjukvårdspersonal idag tillbringar med administrativa uppgifter och dokumentation med en förhöjd interoperabilitet. Det framkom även att patienter har väldigt liten eller obeifintlig kunskap rörande den underliggande säkerheten och hanteringen av personlig information i sjukvården, då de ofta blint litar på att svensk sjukvård anses vara säker samt att patienter prioriterar annat vid läkarbesök. Kunskaper om säkerheten i sjukvården bland patienterna anses dock öka ifall de i framtiden får tillgång till sin journal. Det finns även en allmän oro bland sjukvårdspersonal och närbesläktade instanser för att nya säkerhetsrisiker kommer att uppstå i och med

Fallstudierna påvisade hur övergången till journalsystemet TakeCare generellt har lett till resursbesparinger i form av lokala servrars underhåll och lageranvändning, samt en ökad synlighet i vården med förbättrad tillgång till patienthistorik jämfört med tidigare journalsystem. En ökad kommunikation och medvetenhet samt effektivare interna processer på grund av integrerade moduler och direktkoppling till eRecept kunde även påvisas. Slutligen framgick det att relationer förekom mellan den ökande åtkomsten av patienthistorik och andra journaler, och hur förhöjd interoperabilitet medfört detta. Samband kunde även ses hur ökad interoperabilitet positivt gynnar mobiliteten i sjukvården.

Nyckelord: eHälsa, e-hälxa, affärsmodell, verksamhetsmodulering, Business Model Canvas, BMC, elektronisk patientjournal, EHR, ICT
Acknowledgements

This master thesis represents the final examination of the MSc Industrial Management at the Royal Institute of Technology in Stockholm, which has been conducted during the spring term of January-June 2014.

Firstly, we want to show our deepest appreciation to all employees at Cybercom for the warm reception and interest in our study during our time at the company. A special thank you goes to our supervisor, Joakim Börjesson, for providing us with his constant guidance, insightful comments and frequent feedback. We also want to thank Kit Gullbrandson, who believed in us from the start and made it possible for us to accomplish a master thesis at Cybercom. We also want to express our deepest gratitude to all of the interviewees for their involvement and contribution.

Furthermore, we want to thank our supervisors at KTH: Matti A. Kaulio and Thomas Westin for their critical but honest opinions of our progress and work. It has moreover been a great asset to be able to share and receive feedback from our seminar group, which has been of utmost value during the progression of our master thesis.

Finally, we also want to express a big thanks to our families and friends for their patience and support!

Thank you all very much!

Ludvig Jakobsson
Jonathan Sobin

Stockholm, 10th of June 2014
# Table of Contents

1 Introduction .......................................................................................................................... 6  
  1.1 Background ..................................................................................................................... 6  
  1.2 Problem description ......................................................................................................... 7  
  1.3 Aim & objective ............................................................................................................. 7  
  1.4 Research questions ........................................................................................................ 8  
  1.5 Delimitations .................................................................................................................. 8  
  1.6 Master thesis outline ...................................................................................................... 9  

2 Research methodology ......................................................................................................... 10  
  2.1 Research paradigm and approach for data collection ..................................................... 10  
  2.2 Data collection methodology ......................................................................................... 10  
  2.3 Limitations of the research methodology ...................................................................... 12  
  2.4 Research contributions ................................................................................................. 13  

3 Clarifying eHealth and business modeling .......................................................................... 14  
  3.1 Defining eHealth and its history .................................................................................... 14  
      3.1.1 The 10 standards of eHealth .................................................................................. 14  
  3.2 eHealth in Sweden ....................................................................................................... 16  
      3.2.1 Sveriges Kommuner och Landsting ..................................................................... 16  
      3.2.2 National eHealth ................................................................................................. 16  
  3.3 ICT in relation to eHealth ............................................................................................. 17  
  3.4 EMR and EHR systems in Sweden ............................................................................... 18  
  3.5 Business modeling and business model frameworks ..................................................... 19  
      3.5.1 Business model frameworks .............................................................................. 19  
  3.6 Business Model Canvas ............................................................................................... 19  
      3.6.1 The nine building blocks .................................................................................... 20  
      3.6.2 Application of the BMC .................................................................................... 21  

4 Theoretical framework ......................................................................................................... 23  
  4.1 eHealth in relation to interoperability ......................................................................... 24  
  4.2 eHealth in relation to security ...................................................................................... 26  
  4.3 eHealth in relation to mobility ..................................................................................... 28  
  4.4 eHealth in relation to business modeling .................................................................... 30  
  4.5 Summarized and comprised theoretical framework .................................................... 31  

5 Analysis of empirical gatherings .......................................................................................... 33  
  5.1 Interoperability ............................................................................................................. 35  
      5.1.1 Conclusive summary of the section ..................................................................... 39  
  5.2 Security ......................................................................................................................... 40  
      5.2.1 Conclusive summary of the section ..................................................................... 43  
  5.3 Mobility ......................................................................................................................... 44  
      5.3.1 Conclusive summary of the section ..................................................................... 47  
  5.4 Business modeling ....................................................................................................... 48  
      5.4.1 Conclusive summary of the section ..................................................................... 50  
  5.5 Case study analysis – Business Model Canvas .............................................................. 52  
      5.5.1 A study of Skärholmens ÖNH Centrum ................................................................. 53  
      5.5.2 A study of Karolinska Universitetssjukhuset ....................................................... 55  
      5.5.3 Correlations between impact analyses and prominent aspects ............................ 57  

6 Discussion ............................................................................................................................. 59  

7 Conclusion ............................................................................................................................ 63  

8 Further research ..................................................................................................................... 65  

9 References ............................................................................................................................ 66  
  9.1 Scientific articles ............................................................................................................. 66
9.2 Books and general articles .................................................................68
9.3 Websites .........................................................................................69
10 Appendix A – Business Model Canvas template ..................................71
11 Appendix B – Interview persons ..........................................................72
12 Appendix C – Interview questions .......................................................75
13 Appendix D – EHR systems in Sweden ...............................................80
14 Appendix E - Geographical overview of Sweden’s EHR- systems ..........81
List of tables

Table 1 - The comprised theoretical framework, where identified and influential aspects seen to affect the development and implementation of eHealth services, have been summarized. This framework is to be used as a foundation for the chapter 5, the empirical analysis. If the reader considers any aspect hard to interpret, they are more thoroughly elucidated in their respective sub-chapter in the previous pages ..................32

Table 2 - Hypotheses developed from every individual section of the theoretical framework 34

Table 3 – Key aspects identified from “eHealth in relation to interoperability”, gathered from the theoretical framework (chapter 4.5) .................................................................35

Table 4 – The most prominent aspects seen influencing eHealth services from an interoperability perspective ........................................................................................................40

Table 5 - Key aspects identified from “eHealth in relation to security”, gathered from the theoretical framework (chapter 4.5) .........................................................................................40

Table 6 - The most prominent aspects seen influencing eHealth services from a security perspective .................................................................................................................................44

Table 7 - Key aspects identified from “eHealth in relation to mobility”, gathered from the theoretical framework (chapter 4.5) ........................................................................................................44

Table 8 - The most prominent aspects seen influencing eHealth services from a mobility perspective .................................................................................................................................48

Table 9 - Key aspects identified from “eHealth in relation to interoperability”, gathered from the theoretical framework (chapter 4.5) .................................................................................................48

Table 10 - The most prominent aspects seen influencing eHealth services from a business modeling perspective ..............................................................................................................................51

Table 11 - Concluding table of the prominent aspects for every theoretical concept ............51
List of figures

Figure 1 - Implementation of EHR in Sweden's counties from 2003 - 2012 (CeHis, 2014) ....18

Figure 2 - A BMC showing the interrelations between every segment, which will be further explained in chapter 3.6.1........................................................................................................................................20

Figure 3 - Osterwalder and Pignuer (2010) underlines the importance of, in practice, visualizing the BMC with the help of e.g. Post-it notes ........................................................................................................22

Figure 4 - The individual focus areas of the theoretical framework.................................................................24

Figure 5 - Text in green indicates changes brought upon the introduction of the EHR-system TakeCare................................................................................................................................................................................53

Figure 6 - Text in green indicates changes brought upon by introduction of the EHR-system TakeCare................................................................................................................................................................................55

Figure 7 - Business Model Canvas Template........................................................................................................71

Figure 8 - Overview of the largest EHR systems in Sweden as of 2013 (eHälsa i landstingerna, 2013) .............................................................................................................................................................................80

Figure 9 - Geographical overview of Sweden’s EHR systems (Sjukhusläkaren, 2012) ........81
# List of key acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full form</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMC</td>
<td>Business Model Canvas</td>
</tr>
<tr>
<td>EHR</td>
<td>Electronic Health Record</td>
</tr>
<tr>
<td>EMR</td>
<td>Electronic Medical Record</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>NPÖ</td>
<td>Nationell patientöversikt</td>
</tr>
<tr>
<td>SITHS</td>
<td>Säker IT-användning i hälso- och sjukvården</td>
</tr>
<tr>
<td>SKL</td>
<td>Sveriges Kommuner och Landsting</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
1 Introduction

This chapter initially aims to provide a background and problem description of the subject of the master thesis, explaining why it is of importance and relevance to investigate. The chapter continues describing the overall purpose, the aim, as well as the research questions of the study. Finally, the chapter will enlighten the delimitations that have been drawn, followed by a guiding outline of the report.

1.1 Background

The European healthcare system is today confronted with challenging consequences from the results of a constantly increasing population of ageing citizens, where an cumulative ratio are additionally struggling with chronic diseases and disorders (EU eHealth 2004). Today’s improved standards of living, which have led to generally better health, combined with a continuously more effective health care are ultimately leading populations to grow older. Public expenses related to health care have as a result firmly been escalating during the last two decades and are expected to keep growing until 2060 (eHealth Action plan 2012-2020). This has partly to do with previously stated reasons in combination with a steady drop of healthcare professionals, as well as higher demands from citizens in terms of provided health- and social care services (eHealth Action plan 2012-2020).

Bearing these aspects in mind, the European commission have identified the area of eHealth, which briefly can be described as the utilization and subsequent benefits from implementing information and communications technologies (ICT) in the field of health care, as one of the strongest growth areas on the European market (EU eHealth 2004). The expression eHealth is not a new term in the scope of health care, but actually origins back to the nineties (Vincenzo, D.M, 2001). The area of telemedicine, most commonly known as the usage of telecommunication within the field of health care, is to many seen as a predecessor to eHealth with an even earlier heritage from the seventies (Willemain & Mark, 1971). Although the concept of eHealth was coined for more than a decade ago, its significance as well as alleged, and in many cases proved benefits in terms of both financial aspects but also non-financial, has today made eHealth a highly debated subject. The European commission has therefore conducted several directives accompanied with a continually evolving action plan where future progress associated to the field of eHealth will have a strong impact on a national level within Europe (eHealth Action plan 2012-2020).

When directing the focus on eHealth progress carried out in Scandinavia it can easily be seen that Sweden, although being deemed as a highly developed IT-nation, has good potential to develop its health and social care infrastructure with the support of incorporating modern IT-solutions (eHälsa – nytta och näring, 2011). Reconsidering current business models of those facilities offering health- and social care services could greatly nurture and develop key aspects such as accessibility, mobility, interoperability and customer needs adoption, both from a user perspective (patients/citizens) and provider perspective (doctors/health care professionals). Refinements of ones business model and belonging strategies are also commonly seen to increase value-creation and customer satisfaction, while at the same time sustainably maximize profitability (Boston Consulting Group, 2009). It should however be noted that Sweden’s numerous municipalities and counties commonly have their own, often bureaucratically structured health care systems of dealing with e.g. patient journaling, which impedes the cooperative vision eHealth has written all over itself. Sufficient financial support, lacking wholehearted commitment and inadequate interoperability are aspects that has to be dealt with in order to lucratively achieve both the short- and long term goals derived by the European commission in the pursuit of an eHealth oriented health- and social care (eHealth Action plan 2012-2020).
1.2 Problem description

The evolving European health care infrastructure is, as previously mentioned, confronted with increasing ageing populations, higher ratios of people with chronic diseases and disorders besides continuously rising public health- and social care expenses. As the area of eHealth is becoming an increasingly attended national topic in Sweden, constant pressure and wide expectations are anticipated from the providers of health care services. Customer groups are also becoming gradually more demanding in terms of quality, transparency and efficiency regarding offered health care services. Patients and close relatives willingly to partake as more active roles in making decisions, is another requested desire of today’s health care, which imposes requirements and pressure on patient security and interoperability. To address these constant-changing demands in a complex network of users and providers as well as national laws and regulations will evidently present challenges associated with commitment, cooperation and integration.

Alongside with it also becoming more obvious that both the user and provider side of the spectrum are equivalent keystones in the process of forming the future health care system in Sweden, it would be inconceivable not to adopt a dynamic multi-user perspective. As eHealth initiatives are intended to offer added possibilities for the patient to be more involved in the health care process, it would be also imperative not to consider how this would affect current security- and privacy aspects for it to be well functioning. If one instead focuses on what today causes problems or impedes the development of the health care of Sweden, health professionals are still seen struggling with data journaling systems that lack national coverage and interoperable functions. These so-called EHR systems (Electronic Health Record) tend to historically be of a bureaucratic nature, and not to forget extremely expensive and time-consuming to alter. As a result, there exists an abundance of different EHR-systems with individual associated versions and clients across Sweden’s counties and municipalities, creating a complex network of information not always as easy to access for the users who could be in need of the data.

In the long run, working towards and finding a solution to these problems is for instance argued to improve the mobility of the future health care services both for the users and providers, a necessity in order to attain the increasing ageing population in Sweden. If one were then to utilize a business modeling approach to identify what can be altered in a business model to attain evolving problems in the health care, one would quickly be confronted with additional difficulties as the field of health care is disputed of not being a field where every aspect ultimately can be measured in financial values.

1.3 Aim & objective

With the given background and problem description, the aim of this master thesis is therefore to investigate and interpret the most prominent aspects associated with eHealth services in Sweden. The study also aims to include subsequent benefits that are to be identified from case studies where implementation of an eHealth service have taken place, where a specific focus will be emphasized on EHR-systems.

The objective of the study is consequently to investigate these aspects and benefits from a multi-user perspective, meaning that patients and citizens, as well as doctors and other health care professionals will be regarded as a customer segment when gathering and analyzing the findings of this master thesis. It is ultimately also of interest to combine findings from both theory and practice with the purpose of drawing correlating conclusions.
1.4 Research questions
In order to pursue an answer to the aim and objective of this master thesis, two research questions (RQs) have been formulated:

- **RQ1**: Which key aspects are from an interoperability, mobility, security and business-modeling viewpoint seen as prominent in relation to eHealth services from a multi-user perspective?

- **RQ2**: What internal and external benefits can be identified after having implemented an eHealth service and can these in turn be correlated to the prominent aspects found in RQ1?

1.5 Delimitations
It should initially be noted that it is almost impossible to specifically frame what are to be included and left out in this research due to the field of eHealth already being vastly conversed and complex. eHealth can also be considered as a tumult research area undergoing constant development. There are numerous sub-areas closely interrelated to each other, which further presents difficulties when discussing the actual delimitations of this study. Generally, a rough delimitation would be that this master thesis is to focus on identifying aspects widely recognized as of high importance for a successfully continued development of eHealth services in Sweden, both for the health care professionals and the patients of the services. In order to clarify the relevance of this study however, a more narrow and explicit scope of investigation is necessary, which now will be presented.

This master thesis is delimited to only investigate orientations in the field of eHealth from a set of central theoretical concepts (see chapter 4), which are used as foundation for the constituted hypotheses later presented. The delimiting theoretical concepts have been chosen partly due to narrowing-down the otherwise immensely broad research area, but also due to their seen impact on eHealth services, which is more thoroughly described in their individual chapters. It is worth noticing that the different concepts are interconnected to each other as well as additional orientations of eHealth development, which is why other aspects found outside of the scope of eHealth also might briefly be discussed. The study is further delimited to principally only investigate the eHealth development in the Swedish health care, involving mostly hospitals, private- and primary cares as well as providers of specific eHealth services. The Swedish social care is not being targeted due to mainly not having attained the same eHealth progress as the health care and the majority of the interviewees of the study had larger or exclusive knowledge of the health care in Sweden. It should however be distinguished that the findings related to eHealth and Swedish health care in this report could with the highest likelihood also be applied for the social care in Sweden, which hence would increase the level of generalizability of the study. As one of the main and most costly tools utilized in the current health care in Sweden is EHR-systems and their different administrative functions, the master thesis will in terms of eHealth services delimit the scope of focus on primarily EHR-systems.

The empirical investigation is moreover delimited to the county of Stockholm due to time- and distance constraints, but with a detour to Uppsala municipality to acquire a higher comparative level as well as data triangulation. In terms of the part of the thesis that aims to map essential outcomes and benefits in relation to business modeling and a business framework (see chapter 5), they will be executed without the intention of providing an accompanied strategy of how to work with alternations of one’s business model. However, the purpose of identifying these benefits is to relate them to the findings from the literature review as well as the hypotheses as the research questions stated in chapter 1.4.
1.6 Master thesis outline

The introduction chapter provides a background on the topic, why it is of importance to investigate, as well as the objective, purpose, research questions and delimitations that have been drawn.

The second research methodology chapter will explain the chosen research methodology as well as the methods used during the master thesis in order to answer the research questions. The chapter will also enlighten the paradigm of the thesis, how data has been collected and finally shed light and justify the validity, reliability and generalizability of the thesis.

The third chapter involves the literature review of the thesis, where necessary knowledge of the concept eHealth is presented to the readers to facilitate the continued reading of the report. The chapter also enlightens theories of business modeling with emphasis on a framework that has been utilized in case studies of the thesis.

The theoretical framework chapter of the thesis puts the previous literature review in perspective and goes deeper into four different concepts, interoperability, security, mobility and business modeling. The chapter presents up-to-date issues and pressing debates in relation to eHealth and constitutes a set of hypotheses that are to be verified in chapter 5.

The analysis chapter will provide gathered data from the executed interviews as well as mail conversations in order to initially verify each hypothesis being true or false, as well as identify the most prominent aspects seen related to the development of eHealth in Sweden. The chapter will furthermore present the conducted case studies, where a business modeling framework has been utilized in order to distinguish related benefits after having implemented an eHealth service. These benefits have then, in relation to the prominent aspects been analyzed in order to find answers to the research questions presented in chapter 1.4

The intention of this chapter is to further discuss the most prominent aspects, initially presented in the analysis chapter, seen posing challenges for the continued development of eHealth services in Sweden. This chapter in combination with the previous analysis chapter, will therefore additionally elucidate the answers to the research questions, stated in chapter 1.4

The conclusion chapter reviews the findings throughout the thesis and presents answers to the research questions of the thesis.
2 Research methodology

This chapter clarifies the overall methodology and choice of methods used to conduct this master thesis. Initially, the research paradigm and approach for collecting data is enlightened and justified. Secondly, the methods for collecting relevant data in order to correlate to the objectives and answer the research questions are explained. Finally, the validity, reliability and generalizability of the research are discussed, followed by the intended contributions of the research.

2.1 Research paradigm and approach for data collection

This master thesis will be influenced by an interpretivist approach since the framework of the research is to achieve a greater understanding of prominent outcomes in relation to eHealth development in Sweden. Due to the development and implementation of eHealth services in Swedish health care infrastructure not being as mature as what seems enough to solely rely on positivistic and objective data, which is an underlying aspect to why a more holistic and subjective approach was chosen – which an interpretivist approach offer us. Furthermore, the subject of eHealth is of a very delicate matter with multiple users and providers. This is why the collected data for this master thesis was retrieved from qualitative methods, benefitting from offering “inside-oriented” and so-called “soft nominal” data compared to utilizing a quantitative approach (Collis & Hussey, 2009). The data was gathered from ten semi-structured in-depth interviews and extended mail conversations involving a variety of different individuals with diverse job tasks and titles in the Swedish health care. As the purpose of this study furthermore is to identify and analyze aspects seen as of high importance in the currently complex market of health care and eHealth, the study is thus designed in an approach so that a qualitative method will be most beneficial, centered on the interpretivist paradigm.

2.2 Data collection methodology

Literature review and theoretical framework

To pursue an answer to the research questions (see chapter 1.4), a comprehensive literature review was initially conducted on the present Swedish health care and eHealth development in order to achieve a perception of the causes for the current eHealth wave, its settlement in Sweden and what it actually means and intends. The literature review also briefly incorporates the research area of business modeling and its interrelation to eHealth, with a particular focus on business model framework. The literature review, mostly originating from scientific articles and books, is further accompanied by information gathered from all-encompassing consultancy reports. As the term eHealth is constantly being a victim area of central events occurring on a weekly basis worldwide, an extensive amount of information from different websites, press releases and articles of a more general nature has also been interpreted. It should however be noted that these types of information sources have, according to the authors been validated of high significance, credibility and relevance if being used in the study.

From the literature review of the present eHealth development both in Sweden and generally in Europe, several focus areas and key aspects could be extracted in relation to previous implementations and continued development of eHealth services. These aspects in turn paved the way to which theories that would be most relevant acting as an initial and “to-be-verified” foundation in order to ultimately find an answer to the first research question (RQ1). The theoretical foundation was then decided to be shaped from four interrelated theoretical concepts, where different influencing aspects had previously been shown being of significance to the evolvement eHealth services as well as health care services in general.
The four theoretical concepts involve (1) *eHealth in relation to interoperability*, (2) *eHealth in relation to security*, (3) *eHealth in relation to mobility* and finally (4) *eHealth in relation to business modeling*. All of these individual concepts were rigorously composed after a comprehensive search and browsing of an abundant of both older and more present scientific articles as well as journals by well-cited researchers. With the theoretical concepts as the initial foundation, a total of twelve hypotheses were constructed where interviews were used to either confirm or disprove each hypothesis. The theoretical concepts where then subsequently united into a comprised theoretical framework in order to present an overview of the key aspects identified in each of the four concepts.

**Interviews and interviewees**

The theoretical framework is constructed by secondary sources such as scientific articles and other sources of literature, in combination with the information collected from primary sources from the ten in-depth semi-structured interviews that established the basis for analysis in this study. The semi-structured interviews were conducted with a wide-ranging set of individuals, representing different positions associated to the Swedish health care, namely; Eric Wahlberg (Praktikertjänst, PTJ), Kerstin Arvedson (SITHS-management), Helen Ferm (Cybercom), Maria Kyhlbäck (Akademiska Sjukhuset), Johnny Sobin (Skärholmens ÖNH-Centrum and PTJ), Aron Sobin (Karolinska Universitetssjukhuset, Skärholmens ÖNH Centrum and PTJ), Sofie Zetterström (Inera), Ingrid Fröberg (Edsbergs Vårdbcentral and PTJ), Annika Svedberg (Apotek Hjärtat) and Marianne Norelius (Apoteket AB). The study also achieved relevant data from extensive mail conversations with a representative of the HSA-catalogue associated with Stockholm’s Läns Landsting (SLL). A more thorough description of each interviewee and his or her job position are presented in Appendix B, *Interview persons*. Some of the interviews also included a case study where the application of a business model framework was carried out, which will also be further enlightened in chapter 5. The primary focus of the interviews was to obtain a viewpoint from the interviewees on certain aspects in the current health care, which would later be used for analysis to present an answer to each hypothesis.

For every interview, the timeframe was scheduled to be approximately one hour, where some interviews required additional time in order to fully cover and answer the hypotheses from the theoretical concepts. As previously mentioned, the interviews followed a semi-structured approach in order for both the interviewer and interviewees to alter and ask questions to attain as relevant information as possible (Collis & Hussey, 2009), but still assuring to cover the theoretical concepts. Each interviewee was in beforehand sent a surface consisting of either hypotheses or questions in order for them to be well prepared during the actual interview. The authors of the thesis were also aware when preparing each interview that one must be attentive of prejudiced results and make sure to critically decipher the gathered data afterwards. In some of the interviews, the interviewers were occasionally suggested to contact other persons that the interviewee felt could be relevant for the subject of the thesis. This so-called “Snowball technique” (Noy, 2008) was thus partly utilized during the empirical gathering phase of the study. A comprehensive list of questions asked during the interviews can be found in Appendix C, although all of the asked questions are not listed due being semi-structured.

**Explanatory case studies – Observation of two health care organizations**

Two explanatory case studies have further been conducted as a part of the empirical gathering for this research, with a focus on strengthening the theoretical framework with practical findings. The case studies were performed at Skärholmens ÖNH Centrum and Karolinska Universitetssjukhuset and was carried out in order to cover a set of business-modeling questions related to a framework. The two case studies were conducted with the use of the
Business Model Canvas framework, where the utilization and purpose will be additionally raised in chapter 3.6. The case studies examine how two health care facilities have been affected from having transitioned their whole EHR-system into a new one and what consequences this have resulted in both for the health care professionals working at each facility as well as the patients and citizens. The changes have then been analyzed in what can be referred to as an impact analysis, where the authors of the thesis have examined how these changes brought upon the EHR-system transition can be correlated to internal- and external benefits. Internal benefits are briefly often associated with activities within the health care organization, whereas external benefits on the other hand concern more socio-economical outcomes among other aspects, see chapter 4.4 for more information. Ultimately, the pursued outcome of the case studies was to identify internal and external benefits from an eHealth service transition and illustratively document it.

Process of selecting the prominent aspects
In order to clarify how the authors will select which aspects argued being prominent for each concept in the theoretical framework, a brief guideline of the process is presented below:

- Firstly, the authors of the thesis have carried out each interview with questions that will strive to not be insinuating towards certain answers, which hopefully will make it more obvious to notice if any questions will raise profounder debates compared to others.
- If certain opinions were to be voluntarily brought up by interviewees and also could be related to other responses, this will also be taken into consideration.
- As the authors of the thesis undoubtedly will form their own perception of subject during the study, subjective opinions will also have an influencing impact when evaluating prominent aspects.
- If clear correlations exist between the responses from the interviewees and the previously conducted literature review, it will also be reflected.
- Depending on what job position and previous experience each of the interviewees have, some answers will also most likely be deemed having more impact for the overall evaluation compared to others.

2.3 Limitations of the research methodology
Weaknesses and flaws in a conducted research are often referred as its limitations, which can primarily be oriented to three factors; reliability, validity and generalizability (Collins & Hussey, 2009). The reliability of a study basically concludes how reliable the study is and outlines in to what extent the final result could be repeated and achieved if another researcher attempts to recreate it (Collis & Hussey, 2009). It is often more problematic to demonstrate an interpretivistic study of high reliability that is founded on mostly qualitative methods such as in-depth interviews, due to the fact that a qualitative approach is generally of a more subjective nature compared to methods of a quantitative approach. In order to strive towards high reliability of this research, the authors will be comprehensive with procedures on how the research was conducted by thorough analysis of the collected information with personal opinions and thoughts. All of the interviews carried out during the study have been transcribed in order to enrich the level of reliability. The authors further argue, as the theoretical framework is densely referenced, that it could be similarly used again in a likewise fashion to interview either the same or comparable individuals. The interviewees have also not been presented as anonymous if not being asked, which the authors believe strengthens the reliability. As far as the analysis of the study, it would most likely be difficult to decipher and repeat as the authors themselves decided how to handle the gathered information, thus making it highly subjective. Another aspect that might lower the reliability of the study is how the opinions of patients and citizens all originate from
the experience and thoughts from health care professionals of different positions. A survey was planned to be carried out apart from the interviews, in order to some extent cover the thoughts of the citizens, but were omitted due to limited time, distress of few and biased answers and other priorities.

The *validity* of a study indicates in what degree a finalized research is compared to the originally indented idea (Collis & Hussey, 2009). A research with high validity is additionally often a natural result if the research also has a high level of reliability. There are several ways of improving the validity, where one approach would be to make sure that the literature review should be conducted *in beforehand* of commencing to use the proposed methods, e.g. the explanatory case studies and interviews in the instance of this study. Interviews that are to be executed are conducted to both be appropriately based on the literature and theoretical framework and also strengthening and contributing in relation to the literature. It is also from a validity perspective, constructive if the literature is to be founded on a blend of both previously and recently conducted research, which is pursued in this thesis (Collis & Hussey, 2009).

In relation to this study, one apparent reason why the validity might suffer could be from deviations from the original objective and research questions. This could occur due to fluctuating interest from the researchers during the timeframe of the study or gathered data implying on other attractive paths. An evasive solution to this issue will be the semi-constructed interviews as, although encouraged elucidating relevant sidetracks, they are still based on a predetermined set of questions. A concise document consisting of either questions or hypotheses originated from the theoretical framework were also sent to the interviewees in advance of the interviews, in order for them to prepare. However, a majority of the questions were asked in such a way that the interviewees did not require a substantial understanding of each theoretical concept prior to the actual interview, if not the interview were specifically targeting a certain area. In those cases, the authors took for granted that the interviewee had sufficient knowledge of the subject in beforehand.

Finally, in terms of *generalizability*, which can be defined as to what extent the findings of a study can be generalized and applied on other research areas (Collis & Hussey, 2009), studies that customarily utilizes a qualitative approach are not easy to generalize or reproduce. However, due to the area of eHealth becoming an increasingly more up-and-coming necessity in the field of health- and social care within Europe, the findings of this study would most likely be of use for other researchers investigating related topics.

### 2.4 Research contributions

This master thesis will contribute with up-to-date key insights on how the eHealth development is emerging within the Swedish health care in terms of underlining prominent aspects seen being of high significance. This will acquire not only densely summarizing both previous and current research of the subject, but also analyzing and comprising literature and evaluate it with an extensive empirical investigation consisting of a broad set of interviewees with different job positions associated to the Swedish health care. This master thesis will also cover opinions and impacting effects for both the users and providers of the Swedish health care, thus applying a multi-user approach. The research will also present a universal understanding of how the eHealth development can be discussed and related to business modeling. The authors of this master thesis further argue how the wide span of individuals with diverse job roles interviewed during the study, alongside covering both a thorough theoretical review and real-world impacts eHealth service implementations has shown, is argued to provide holistic insights, unanimously of relevance to the Swedish health care.
3 Clarifying eHealth and business modeling

This chapter aims to explain the concept of eHealth, both in terms of what it is referring to, its interrelation with ICT technologies, and its relation as well as prevalence to Sweden. The chapter additionally intends to provide an initial and required knowledge base of the subject for the reader in order to help setting the following chapters into relevance. The chapter further aims to elucidate the concept of business modeling and lastly illuminates a business model framework called Business Model Canvas.

3.1 Defining eHealth and its history

In order to explain the term eHealth, it is fundamental to first define what is meant when one is referring to the term health. According to the World Health Organization (WHO), whose definition of health origins from 1946, health is defined as: “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1946). When adding the “e” to the term, it basically indicates the added utilization of digital technologies, which in order may increase the possibilities to achieve a well-functioning, equitable and accessible healthcare for everyone in a community (Svensk sjuksköterskeförening 2012). If one yet again chooses to investigate how WHO consequently have defined eHealth, it is stated:

“eHealth is the use of information and communication technologies for health” (WHO, 2011a).

WHO further explained eHealth as “the application of digital technologies used to treat patients, conduct research, educate students, track diseases and monitoring public health” (WHO, 2011a). As towards the usage of the term, there are varying opinions from the literature whether it refers to a new area within the field of healthcare or simply being a substitutable term for the existing fields of telemedicine and health-informatics or health telematics (Eysenbach et al. 2001). However, digitalized telemedicine has faced an enormous boom in computerization and rapid Internet evolvement during the last 25 years, which has led to a regeneration of what started out as telemedicine and now commonly referred as eHealth (Eysenbach et al. 2001). If one zooms in on the development of eHealth within Europe, the European commission has identified eHealth as one of the strongest growth areas on the European market (Commission of the European Communities, 2004). Several action plans have been constituted where mutual guidelines are being developed on how European nations are to individually work with eHealth services to fully prosper from it (Commission of the European Communities, 2012).

3.1.1 The 10 standards of eHealth

Gunther Eysenbach (2001), a well-cited researcher within the field of eHealth, argued about the importance of how the term eHealth comprehends additional aspects apart from purely electronic and technology-oriented relations. Eysenbach therefore defined eHealth as:

“eHealth is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology” (G. Eysenbach, 2001).
The definition encompasses how eHealth is not only combing existing health care and medicine with the added benefits of information and communications technologies (ICT), but also the importance of viewing eHealth as a philosophy of how to improve health- and social care from a more holistic perspective. Eysenbach (2001) further clarified eHealth with the help of ten different “e’s” apart from the obvious electronic, which briefly are explained below.

The ten described standards of eHealth by Eysenbach (2001) present a comprehensive framework of aspects that is argued crucial to constantly consider in order to advantageously implement eHealth services in health- and social care infrastructures. The standards also enlighten how eHealth implementations can be beneficial in a dynamic and persistently changing environment, which health- and social care infrastructures are reflected being (Howard S. Berliner, 1989).

1. **Efficiency** – A desired outcome of eHealth is to strive to increase the efficiency in the healthcare. This would ultimately result in lowered costs and could e.g. be achieved with reduced waiting times by avoiding unnecessary diagnostics.

2. **Enhanced quality** – eHealth should also ultimately enhance the quality of care. By always e.g. redirecting patient streams to the most suited providers of healthcare would most likely increase the efficiency and therefore also the quality.

3. **Evidence based** – In order to achieve increased efficiency and enhanced quality, evidence based results and evaluations will be required.

4. **Empowerment** - eHealth intends to make e.g. personal electronic records more interoperable and available for the concerned persons and therefore giving them increased authorization to make participatory decisions.

5. **Encouragement** – A more shared decision-based relationship are to exist between the patient and the doctor.

6. **Education** – By for example making it possible for a patient or citizen to education him- or herself through online sources.

7. **Enabling** – Strive for a standardized information and communication exchange between cooperative healthcare departments and data management systems.

8. **Extending** – Generally extend the scope of what is associated to be within the borders of healthcare by e.g. eliminating geographical limitations for communicating between patient and health care professionals all over Sweden.

9. **Ethics** – With the intended new cooperation possibilities from eHealth implementation, ethical aspects such as security, integrity and authorization needs to be reflected.

10. **Equity** – As eHealth aims to make health- and social care more equitable, one must be cautious so that customer segments who may not have access to modern ICT technologies due to different circumstances, does not consequently become absent of newly created opportunities when they in fact could be the segment that should benefit from those new eHealth services.
3.2 eHealth in Sweden

The term eHealth apparently can be said to have its breakthrough in Sweden when the strategy related to national health- and social care called Nationella IT-strategin för vård och omsorg was retitled to Nationell eHälsa (Socialdepartementet, 2010). The strategy’s primary intention is to constantly improve the information management related to citizens, health- and social care personnel as well as decision-makers in health care and social services with the aid of ICT tools and technologies (Socialdepartementet, 2010). eHealth actions should further create and nurture environments for future safe and quality assured health- and social care among the different municipalities and counties in Sweden (Fransson and Häfström, 2013). Apart from the European commission stating eHealth as one of the strongest growth areas on the European market, Sweden is said to have vast possibilities to produce competitive organizations that could emerge within the field of eHealth, and develop products and services, which in turn could be attractive on the international market (eHälsa – nytt och näring, 2011).

3.2.1 Sveriges Kommuner och Landsting

Sveriges Kommuner och Landsting (SKL) is representing both the governmental, professional and employer related interest of Sweden’s municipalities and counties. It is an association that is primarily responsible for the current eHealth initiatives in Sweden. Their main aim regarding eHealth initiatives is to strive for a continuously increased integration and cooperation between and within regions, municipalities, counties and private/non-profit providers of eHealth services in Sweden (Fransson and Häfström, 2013). Within SKL, there are two major subdivisions that are in the forefront of working with Sweden’s future health- and social care, which are:

- **Kommunal eHälsa** – A program within SKL that nationally, municipal and privately conducts work to realize the aims of the national eHealth strategy in Sweden with a focus on social care. The work is directed with the help of selected eHealth coordinators from every regional- and local government federation (Fransson and Häfström, 2013).

- **Center för eHälsa i samverkan, CeHis** – CeHis is an organization that coordinates both the counties’ and regions’ work in fulfilling and realizing the national eHealth strategy of Sweden with an emphasis on making sure that accessible and secure information is available within the health- and social care (CeHis, 2014).

3.2.2 National eHealth

Sweden’s national strategy related to eHealth is called Nationell eHälsa, or national eHealth in English. The aim of the strategy is to work with how the future health- and social care in general should function and be enhanced by the adoption of ICT and eHealth services in Sweden. The strategy involves cooperation from national, regional and local levels where several eHealth services are being developed to guarantee that all patients and citizens as well as health- and social care providers are given the opportunity of obtaining information and services of safe and high quality using ICT (Nationell eHälsa, 2010). The strategy encompasses several challenges for the future Swedish health care system, where four major focus areas are listed below (Nationell eHälsa, 2006):

- **Increased patient empowerment** – Allow patients and relatives to take a more active role in terms of decisions and planning related to their own provided health care.

- **Patient information and electronic medical record security** – Guarantee that security- and authorization criteria’s are of highest importance for each patient.
• **Lack of interoperability** – Tackle the current poor levels of interoperability among different health care facilities and their respective systems.

• **Tackle the increasing ageing population** – Work to deliver an improved health- and elderly care for Sweden’s aging population.

In order to realize the objectives of Nationell eHälsa, a continuous work involving several larger projects are being carried out. Some of the larger projects organized by Nationell eHälsa, that partly has been implemented and are continuously being developed are:

• **NPÖ, National patient-overview** – A central service in Sweden’s strategy for national eHealth. Individual medical records can through NPÖ become available to all electronic health record systems and health care professionals, if the concerned patient given authorization (Nationell eHälsa, 2010).

• **1177 Vårdguiden** – Sweden's universal gathering place for information and services in the health care. It is a forum that offers advice and guidance and intends to develop additional eHealth services within the field of health care. It is a service open 24h per day, offered by the Stockholm County Council as well as other counties and regions in Sweden.

• **My health care contacts** – A service that provides individuals with the opportunity to e.g. book and re-book appointments online, apply for medical recipes as well as ask questions and general advice. The service is gradually striving to offer more and more forward-thinking services as it constantly is being developed.

• **SITHS, National identification service** – A national security solution for electronic identification and secure communication of information. By using a SITHS identification card, a health care professional can identify themselves by strengthening their identity regardless of the organizational or geographical boundaries.

### 3.3 ICT in relation to eHealth

ICT stands for *Information and communication technologies*, where a general usage of the Internet has resulted in the creation of electronic based systems, which in turn are used for transmission of information (Ruxwana et al. 2010). As the field of health- and social care is highly information intensive, the application of ICT is therefore an integral part of all health care. Black et al. (2008) argued how the usage of ICT in the health- and social care is beneficial to both facilitate provided care from geographical distances, but also in terms of assisting the storage, transfer and general handling of medical data. In Sweden for example, there has been a steady increase of implementing *electronic health records* (EHR) among all counties with the aid of ICT, where EHR-systems now are available at a majority of hospitals, health centers and psychiatri as *figure 1* illustrates on the following page. It should however be noted that although EHR-systems are argued to greatly improve the documentation of patient health records (CeHis, 2014), there is no unanimous EHR-system in Sweden that nationally functions across all counties and municipalities, which is one of the aims, which the Swedish national eHealth strategy intends to realize.
3.4 EMR and EHR systems in Sweden

An electronic medical record (EMR) is a digitalized form of the previously hand-written version, containing a patient’s medical history from all his or hers health care visits (HealthIT, 2014). The purpose of an EMR is that it is to be used by providers such as doctors and GPs to examine e.g. previous treatments and diagnoses, as it both tracks, monitors and identifies medical data and other relevant parameters, which in turn improves the efficiency of future health care visits and can thus be seen as a crucial part of eHealth development. The major difference between an EMR and an EHR is normally that EHRs include a more comprehensive medical history of a patient, which can origin from visits from different types of patient care facilities such as e.g. hospitals, psychiatrists and other specialists (HealthIT, 2014). In the Swedish health care, there has since long existed a wide utilization of different EHR- and EMR systems, which have caused several integration problems that Nationell eHälsa strives to solve (eHälsa i landstingen, 2013). As of year 2013, there are five major EHR systems representing 96 % of Sweden’s operating health professionals. The EHR-systems are ordered below from a falling magnitude with belonging user percentage (eHälsa i landstingen 2013) and geographical spread, and are further illustrated in Appendix D and E.

- Cambio Cosmic (27,6 %)
- Siemens Melior (25,9 %)
- Take Care (20,6 %)
- Systeam Cross (10,4 %)
- VAS (7,7 %)

To further complicate the already existing interoperability problems resulted from different systems, Cambio for example often has, for every county, a unique configuration that in practice means a partially different system, not fully interoperable with each other. NPÖ, as previously explained, is although argued to be an initiating solution to this problem (eHälsa i landstingen, 2013).
3.5 Business modeling and business model frameworks

Among the vast literature about business modeling, *business process model* is often a recurring term. The term is furthermore regularly and mistakenly associated as the same thing as a business model. Additional confusion arises when one naturally would assume that *business modeling* has to do with business models, whereas in fact it involves modeling *business processes* on an operational level. By scrutinizing the different terms from a conceptual viewpoint, the differences could be summarized into the words: “what” and “how”. A business model could simply be described as *what* an organization does to create value and generate revenue, while business process models focuses on *how* these intentions should be organizationally apprehended, which is by many also associated as the *strategy* of the organization (Osterwalder et al. 2005).

3.5.1 Business model frameworks

When designing a business model, it is obviously dependent on whether a company’s activities are mostly of an economical, component or strategic nature, which defines a business’ approach of generating value streams. Literature states how a business model should be constituted with a *framework* that always aims to answer three general but important question areas being (Krumeich et al. 2012):

1. *Why would somebody want to buy a product/service from you?*
   An organization should ask itself this question in order to find out exactly what their *actual value proposition* is. It is also of importance to identify what *job* the customer wants carried out in terms of products or services and not convincing the customer about the value an organization’s current offerings has.

2. *How will your organization generate revenue from selling a product/service?*
   Organizations need to specify their overall so-called *profit formula*, which compromised is their model of how they are generating revenue and their cost structure including aspects such as *direct- and indirect costs* as well as *overhead costs*.

3. *How, as precisely as possible, will your organization pull this off?*
   The last question tackles the process of identifying an organizations *resources* and *activities* that are essential in order to deliver the offered value proposition for the customers.

3.6 Business Model Canvas

In 2010, Osterwalder & Pigneur released a self-published book called *Business Model Generation*, which is partly based on Osterwalders previous work (Osterwalder et al. 2010). The book can be seen and utilized as a visual template for businesses aiming to create a *new* or *rebuild/document* their existing business model, with belonging strategies and other managerial guidelines. Osterwalder et al. (2010) describe how a business model fundamentally is *how an organization creates, delivers and capture value* and further emphasizes the significance of understanding the holistic objectives and purposes of every part of a business model (Osterwalder et al., 2010). In the book, Osterwalder et al. (2010) define what they refer to as a *Business Model Canvas* (BMC), being a framework portrayal consisting of nine different blocks representing a certain part of a business model with its interconnections and how it visualizes the logic of how a company expects to make profit (Business Model Generation, 2010). The overall BMC framework template can be seen in Appendix A, whereas figure 2 shows the interconnections between the different segments. The BMC can also be seen as a *blueprint* for how a strategy should be applied through process, systems and organizational structures (Osterwalder et al. 2010).
3.6.1 The nine building blocks
The nine building blocks of the BMC are divided into four main areas that together constitute the overall business model, which Osterwalder et al. (2010) ordered as accordingly:

- **Resources**
- **Offer**
- **Client**
- **Financial performance**

**Resources**
**Key activities** - Describes the most critical activities a company must offer and perform to make its business model successfully function.

**Key Resources** – Key resources are basically the required resources to generate value for the customer. It is assets to a company that is indispensable in order to maintain the business. These resources could either be human, financial, physical as well as intellectual, and are either leased or possessed by the company or developed key partners.

**Key partners** – A business model needs a buyer-supplier relationships to focus on their core activates and also reduce risks. A network of suppliers and partners are therefore always present in a business model. It could either be a collaboration, joint venture or coopetition partner depending on the buyer-supplier relationship.

**Offer**
**Value proposition** - This block describes the bundle of products/services that generate value for a specific customer segment. It is the value proposition of a business model that makes it possible to distinguish a business model from the ones of its competitors. The proposition gains value from the help of elements such as cost savings, difference in price, accessibility or risk reduction and are either of a qualitative or quantitative nature, for example meaning price-focused or overall customer satisfaction oriented.
Client

Customer segments - Defines the different groups or organizations a company and or enterprise aims to reach and serve. To be able to create a successful business model, there is fundamental need to investigate which customers the model is intending to serve. The purpose of this block is to define what type of customer segmentation a business model are aiming for since it is troublesome to satisfy all segments of customers.

Channels – This block describes how a company reaches and communicates with its customer segments to deliver its value propositions. A company then has to decide if they should be reaching out to their customer segment with its own channels, with its partner’s channels or a combination of both. When dealing with partner’s channels, it often results in lower margins but on the contrary presents the opportunity to allow an organization to expand due to the extended network from its partners.

Customer relationships – This block defines the type of relationship a company has to create with their customer segments. Osterwalder et al. (2010) argue about how a relationship either could be self-serviced, co-created, community based, personally assisted or automated.

Financial performance

Cost structure - Within this block a company is able to identify the most vital encountered costs operating a certain business model. To be able to calculate these costs, key resources, key activities and key partnerships have to be identified. This block is e.g. convenient since it aids a company’s ability to distinguish if their business model either is or should be value-driven or cost-driven. A cost-driven business model exclusively focuses on minimizing cost, while a value-driven business model instead aims on generating value for its customers, which is commonly applied in the field of health- and social care (Osterwalder et al. 2010).

Revenue streams - Clarifies how a company generates revenue from each customer segment. Revenue streams can basically be defined as the cost subtracted from revenues, which results in generated earnings. Many mistakenly believe how this block must be the heart of the business model canvas as it honestly reflects how much the customers are willing to pay, but equal attention must be given to each and every block in order to be prosperous (Osterwalder et al. 2010).

3.6.2 Application of the BMC

There is no unanimous method of how to conduct a BMC, but Osterwalder et al. (2010) argue from their experience and history of conducting workshops that the best approach is to print it out on a larger surface to visually foster collaboration among groups from several hierarchy levels within a company. Personnel could then with the help of Post-It notes sketch and discuss what they believe are prominent elements needed to be analyzed within every building block of a business model. The BMC should hence be seen as a practical and visual hands-on-tool that always can be viewed and accessed by all layers of employees within a company (Osterwalder et al. 2010). Figure 3 on the following page is an illustrative example of how a BMC could be applied in practice. In Appendix A, a template of a BMC is illustrated.
Figure 3 - Osterwalder and Pigneur (2010) underlines the importance of, in practice, visualizing the BMC with the help of e.g. Post-it notes.
4 Theoretical framework

The chapter aims to present a set of theoretical concepts and hypotheses, which will constitute what will be the theoretical framework for the thesis. The hypotheses will then, in relevance to the framework and the previously presented literature review, be used as a foundation in interest of elucidating aspects and outcomes related to eHealth implementation and development. The chapter will lastly unite the concepts into a concise and explicable framework, which will be used in relation to the empirical findings for analysis and verification.

The theoretical framework of this master thesis aims to assemble a set of different focus areas where aspects from each area are, from previous research, considered being prominent and reoccurring in correlation to the development and implementation of eHealth services. The discovered aspects in each focus area are to be thoroughly described and will act as foundation for to the constituted hypotheses, which are to be empirically strengthened and verified in the forthcoming empirical chapter. It should also be noted that additional aspects might be elucidated in chapter 5, as the interviews followed a semi-structured approach, which invited for a broad discussion of other relevant aspects to consider. The findings in this chapter can correspondingly somewhat be seen as an initial answer to RQ1 (see chapter 1.4), but are to be further strengthened from the gathered empirical data.

The focus areas of the theoretical framework that have been chosen are eHealth in relation to interoperability, eHealth in relation to security, eHealth in relation to mobility and eHealth in relation to business modeling, which can be seen in figure 4 in the following page. The first concept about interoperability has been chosen due to one of the basic principles of eHealth according to Eysenbach (2001) and is how eHealth services are to promote increased efficiency and be enabling (see chapter 3.1.1 for further explanation). In order to approach those goals, obvious criteria would be an interoperable health care where EHR-systems, among other aspects, cooperate with each other. It is therefore of relevance to investigate what interoperability is defined as in relation to health care and what consequences it has seen to be associated with.

Subsequently, in order to approach an interoperable health care, it goes without saying how underlying security, integrity and privacy matters are also of utmost importance, especially in the field of health care where sensitive patient data is being handled. The framework will thus scrutinize what previous and current research has denoted as prominent aspects in terms of security. The third focus area of the framework will confront how eHealth is interrelated to mobility aspects. As another intention of the eHealth wave is to encourage and present citizens and patients the ability to take more responsibility and become more involved in their health care (EU eHealth 2004), it felt appropriate to moreover investigate mobility and accessibility factors, which also are somewhat dependent on previous interoperability and security aspects.

Lastly, to further achieve a wider knowledge base in order to support an answer to RQ2 (seen in chapter 1.4), eHealth will also be investigated in conjunction to business modeling research. It will here be relevant, among other aspects, to identify if there are any similarities or dissimilarities of applying a business modeling philosophy in the field of health care, where purely monetary gains are not the only important elements. The authors would also like to highlight the advantage why a multi-approach framework has been utilized, since if any unexploited aspects or issues have not been discussed in one of the chapters, they might instead been caught and revealed in another concept as the different frameworks are somewhat interrelated to each other.
4.1 eHealth in relation to interoperability

In order to strive towards a health care that offers both high quality, secure and efficient services, a shared and cooperative care is required (Blobel & Stegwee, 2012). In order to realize this approach, information sharing and well-functioning communication are keystones in what generally is referred to the interoperability in relation to ICT (IEEE, 1990). The definition from Institute of Electrical and Electronics Engineers (IEEE) is well cited in previous academic research, and is stated: “Interoperability is the ability of two or more systems that are used to exchange information and to use the information that has been exchanged”. As “exchanging information” can be utmost diverse depending on in what framework it is mentioned, within the field of health care and especially eHealth, interoperability often signifies the capabilities a health information system (e.g. EHR-system) has working together with another health care organization, possibly across administrative boundaries (IEEE, 1990). Interoperability in relation to eHealth has therefore been defined as: “The ability to communicate and exchange data accurately, effectively, securely and consistently with different information technology systems, software applications, and networks in various settings and exchange data such that clinical or operational purpose and meaning of the data are preserved and unaltered” (G. Patricia et al. 2007).

However, Blobel & Stegwee (2012) and Lesh et al. (2007) argue how interoperability in relation to eHealth does not simply comprise a purely ICT and computerized ontology revolving around for example transmission- and hardware issues. But today also encompasses an equally sought after social interoperability where focus instead could be put on e.g. efficiency or the relationship between technology and the human being. Lesh et al. (2007) further elucidated the importance of in order to implement interoperability in relation to eHealth services with successful outcomes, a functioning technical interoperability would suffer if an interface between technology and individuals is not also established, which presents us with our first hypothesis, H1:

H1: Both technical- and social interoperability is equally imperative for the health care to continuously improve

Another aspect raised by Brailer (2005) is how higher levels of interoperability in relation to health information systems such as EHR-systems, foster longitudinal medical records as well as easy access to patient records and reduction of medical errors, all qualities seen to improve health care professionals abilities to offer better diagnosis for each patient (Iroju et al. 2013). The application of interoperability in the field of health care is further claimed to aid different care providers to take part of and understand diverse area-specific terminology and concepts, where the original medical message still is delivered when data is transmitted from one system to another (Pan et al. 2005). Brailer (2005) additionally interpreted how an increased interoperability simultaneously would be beneficial for the patient as well. Hypothesis two, H2 is now presented:
**H2:** Increased interoperability is a prime driver for health care professionals to better perform diagnostics on their patients

Adding upon the discussion of interoperability, a central question that is frequently mentioned in previous research is how interoperability should be aligned with current EMR- and EHR-systems (Iroju et al. 2013). On the present Swedish health care scene, numerous medical information-handling systems and all of its unique configurations, which divide them to yet another level, present obstacles when an effective approach of distributing and communicating information is being pursued. However, as EHR-systems are being utilized to improve the quality, efficiency and safety of health care (Poissant et al. 2005), some health care practitioners have criticized the impact it has seen to have on time that actually is value-adding to their customers. Studies show how an increasing amount of health care professionals, where primary attention is focused on doctors, spends a great fraction of their workday on *documentation and administrative issues* instead of spending time examining and consulting the actual patient (Sjukhusläkaren, 2014). *Increased patient-interaction time*, a coveted outcome from increased interoperability, has not always been seen to be the end result, as there frequently occur so-called “double documentation” where similar medical data is being documented twice or more in parallel systems (Sjukhusläkaren, 2014). Another hypothesis, **H3**, can now be formulated:

**H3:** Increased interoperability has led to excessive time spent with administrative work and documentation for health care professionals instead of devoting the time interacting with the patient

As previously noted, the field of eHealth has intentions to confront the increasing costs of today’s health- and social care. Some articles however argue how there is little economical evaluation of eHealth in what extent it will demonstrate potential monetary gains and adequate return on investments, ROI (Schweitzer & Synowiec, 2012). Introducing interoperability among health care ICT systems, is in a long-term perspective reasoned to bring financial benefits due to several other health care parameters subsequently being improved such as patient satisfaction and enhanced knowledge management amid various stakeholders. However, refining the exchange of health information and interoperability to an ideal level, so as to allow continuous access and transfer of medical data in every relevant setting, which will most likely present cost-savings in the long-run (Car et al. 2008), will unsurprisingly require significant upfront investments in ICT such as hardware, software, training and other recurring costs. These initial obstacles are unfortunately often seen to hinder investors to realize and grasp the long-term benefits beyond the start-up costs (Dobrev et al. 2010). It is therefore important to constantly interpret the monetary values that would be attained from other health care qualities and also ponder if incentives from governments and other payers is required to overcoming cost barriers. Bearing these aspects in mind, hypothesis four, **H4** is presented:

**H4:** Increasing the interoperability in the health care directly results in monetary gains

This chapter is comprised of how eHealth in relation to interoperability enlightens aspects of combining both social- and technical interoperability and the potential benefits increased interoperability would have to health care professionals providing diagnostics for the patients. It further discusses if interoperability also entails counterproductive excessive time spent documenting and finally reviews the potential monetary gains it might bring.
Beyond all the advantageous assistances and possibilities eHealth services provide health care professionals and patients, assuring well-functioning and credible information management of classified and personal patient data as well as authorization management is seen to be of highest importance (Salvi et al. 2010). Security aspects have become a fundamental topic along the evolving utilization of ICT in health care, in order to guarantee the privacy and confidentiality of individual’s medical data. One of the primary challenges facing eHealth providers and different sources of medial data is how to manage ubiquitous access demands from numerous users over multiple channels that asks to get hold of information. Aspects of security involve how sensitive information is to be protected and only authorized by approved users, where Tan (2005) reasons how one of the most difficult tasks for eHealth security is therefore how to organize and maintain gradually more complicated applications in varied settings while still upholding a sufficient security level. However, the health care is at the same time steadily carrying out actions to simplify and streamline the individual health care provided to patients and citizens, where e.g. patient records are becoming accessible online and test results can be notified and delivered through mobile phones. Profitable outcomes in terms of increased efficiency, better treatment and improved mobility have to simultaneously be compared to the sensitivities of disregarding personal intimacy, which further elevates issues about privacy and data security (Petoković, M and Ibraimi L, 2011).

In terms of EHR-systems and its association to security, there are obviously numerous protocols and standards that need to be satisfied and maintained. Measurement requisites such as encrypting stored information, access control management with e.g. PIN-codes and so-called audit trail features, which registers what information has been accessed, when and where and if it has been altered, are all becoming increasingly more evolved and added to required security criteria (HHS, 2014). At the same time, parallel to the continuous enhancements of security standards, some researches claim how EHR-systems in fact, in some cases, jeopardizes the trustworthiness and the perception of EHR-systems actually being secure (Layman E.J., 2008). Patients’ health records are often being shared and/or linked between systems without the patient’s knowledge, which have unfortunately caused a lack of confidence in the security of medical data where patients have been induced to obscure delicate personal information as an outcome (Layman E.J., 2008).

When one speaks about security in terms of health care, it is closely interrelated to privacy and confidentiality (Tan, 2005). As the term privacy relates to an individual’s right to hinder his or hers medical health data from being shared with others and regulating what information that can be revealed, confidentiality refers to the obligation of health information keepers to only use or reveal the information if he or she is authorized to do so. In relation to security, literature unanimously states how security is denoted of being e.g. the techniques and procedures used to protect health information from unintentionally being misused or leaked (Tan, 2005). As the eHealth movement further has given health- and social care a new dimension, it is argued how it also have brought risks to patients’ medical records, posing new security threats partly due to medical records becoming more accessible and mobile. As eHealth services and interoperable EHR-systems are widely founded on well-established security protocols and standards (Wainer et al. 2008), but ominously also seen as counterproductive in some cases, hypothesis five, $H_5$, is formulated:

$H_5$: The evolving wave of eHealth services is alleged presenting new security risks, which could jeopardize patient’s medical records
Tan (2005) has additionally reasoned that the most fundamental ingredient for a functioning eHealth information system is to assure patients and citizens as well as health care professionals that the intention of an information system is to present enhanced health care as opposed to e.g. abuse of medical information or eHealth services being inadequate to satisfy their requests. However, there seems to be reluctant opinions whether the user side, referring to patients and citizens of the society, is sufficiently aware and updated on the security aspects of EHR-systems that are containing their personal medical information, which in some cases results in lacking trust (Tang C. et al 2006). Even though a health care provider might be well aware of how the information about a certain patients are securely stored and if transferred among databases, doing so in accordance to national standards and technical protocols, the patient not knowing the same details, could result in feeling uncomfortable and a overall decreased health care experience (Tan, 2005). Patientsäkerhetslagen (2010) further pronounces how patients and relatives should always be given the opportunity to participate in security aspects of the patient in question. Health care providers should, for example, offer routines where they actively encourage patients and families to question whether there is something they wonder or feel insecure about regarding the security of their health care. Hypothesis six, H6, is therefore:

**H6:** Patients, citizens and health care professionals are well aware of the underlying security of todays EHR systems and how health records are being managed

As eHealth services more gradually involves an increased usage of ICT tools and primarily the Internet, which presents several previously mentioned benefits (Black et al., 2008), there are considerable demands that a stable, functioning and secure Internet connection is being maintained. Internet based EHR-systems according to Roy and Charles (2000) offer a set of benefits being for example:

- Immediate access of entire patient longitudinal health records
- Generally more effective gathering of health information
- Patients can self-report or monitor their condition(s)

However, Agbele et al. (2009) discussed how there also are potential risks that should be brought to light besides the benefits of Internet based EHR-systems that could result in consequences that are both costly and could cause serious health damage. An example of one hazard is the consequences of relying on an Internet infrastructure that suddenly would fail (Agbele et al., 2009). Health practitioners are further seen seldom putting much thought into what consequences a software downtime would have if not being translated and compared to its financial loss (Stratus, 2011). To expose the gravity of this security guarantee, one of Sweden’s largest medical record systems, TakeCare, have been struggling with downtime at several occasions over the last few years with severe risks of causing health damage for every occasion (Läkartidningen, 2013). Hence, it is of interest to formulate hypothesis seven, H7:

**H7:** Internet connectivity is today functioning well and is not considered being an Achilles heel in terms of security among health care facilities

This chapter encompasses if the wave of eHealth services in relation to security is also presenting new security risks for EHR systems and could jeopardize patient’s health information, and whether both patients and health practitioners are today well aware of the underlying security of EHR-systems and conducted health care. The chapter lastly discusses the benefits and pitfalls that ICT and Internet based information systems present, as well as the significance of stable Internet connections to avoid costly downtime.
4.3 eHealth in relation to mobility

Somewhat related to the aspects of sub-chapter 4.1, a desired and most natural consequence from improved interoperability would be its mobility impact. Oxford Dictionaries (2014) defines mobility as “The ability to move or be moved freely and easily”, which when applied to health care often instead relates to patient mobility. The concept of patient mobility basically describes the movement of patients beyond their so-called “catchment area” to health care, meaning where health care could be offered apart from a patient's area of residence (Glinos and Baeten, 2006). As described earlier, interoperability summarized refers to the exchange and communication of data between systems (see chapter 4.1) and its results are seen to have several benefitting advantages in other parts of the health care, where mobility is one of them (Tan, 2005). In a perfect interoperable health care, patients would be able to move freely between different clinics and given the opportunity to decide who they prefer treating them, as longitudinal health information would be securely accessible at every clinic without the patient needing to fear sensitive information loss. Studies also indicate how there seems to be an interrelation between interoperability and mobility, but also security aspects (Brailer, 2005), as individuals as a result are provided with mobility benefits in terms of e.g.:

- Numerous new and additional choices of medical treatment clinics
- Access to eHealth services such as briefing ones medical records at home
- Quicker reception of test results and consultation from e.g. GPs and doctors with the aid of smartphone technologies

As brought up in chapter 4.2, security is constantly of highest importance in health care due to personal and sensitive medical information being addressed. Slamanig (2008) reasoned how security and privacy issues nowadays must be even more carefully considered, and partly lay the foundation for constituting how accessible medical data can become, as patients EHRs are increasingly becoming more accessible online as part of new eHealth services. It therefore appeared relevant to investigate these interrelations and hypotheses eight, H8, is hence formulated as:

**H8:** Interoperability- and security aspects are considered being what primarily limit how mobile the health care can become

As the mobile development affects other industries and sectors of society, it is also evident how it also gradually will transform the health care. Mobile technology strives to make many elements of the health care more effective, individualized and provide the patient with greater transparency (Free, C et al. 2013). A study carried out by PwC and EIU showed that there is a high demand for mobile health services and that it will increase in the upcoming years (Global mHealth Outlook, 2012). It is in the study further discussed, despite high expectations both from patients and health care professionals, that the application of new mobile solutions in the health care is not fast enough. It was also shown that the main obstacles are not associated to technology aspects, but rather related to the current health care structures being challenging to transform. Literature also seems unanimous that eHealth in terms of mobility is essentially about increasing the accessibility to the patient and citizen as well as the health care provider (Global mHealth Outlook, 2012). Another coveted request, which also could be said being one of the indented core purposes of eHealth services, is to develop means for patients to take greater control of their own health, take more responsibility and be more involved (eHälsa i kommunerna 2013-2015) excluding geographical locations (Tan, 2005). The study by PwC and EIU (2012) additionally revealed how patients who already had begun utilizing mobile health solutions also favored it and how it had more or less replaced routine
checkup-visits to their doctors. The health practitioners that conducted their work with the aid of mobile solutions together with their patients also felt that their health care could be executed more effectively (Global mHealth Outlook, 2012). Bearing these aspects in mind, hypothesis nine is now stated:

**H9:** There is a sought after desire both from patients, citizens and health care professionals for an increased mobility associated to both received and provided health care

Another major advantage seen frequently discussed by eHealth authors in terms of mobility is how unnecessary and expensive in-patient care fees could be avoided if EHR-systems would be more interoperable (Tan, 2005). If denoting mobility in relation to eHealth, it is by Eysenbach (2001) argued crucial to apply an equity perspective, meaning for example how the customer segment consisting of an ageing population is made sure not being left out due to not having access to modern ICT technologies. Focusing on assisting the older populations ability to independently affect their own health- and social care, would significantly contribute to the reduction of health care cost by avoiding unnecessary hospitalizations and ensuring that those who need urgent care, independent of ones geographical location, can get it sooner (Eysenbach, 2001). If a patient’s medical information further would become available (after authorization by the patient) to another health care provider in an entirely different county in Sweden, it is argued how it would both save non-value creating time for the patient caused by existing monitoring systems, as another health care provider now easily could retrieve the sufficient medical information, while the patient would not have to ponder about her whereabouts in order to get efficient or immediate care (Nationell eHälsa, 2010). In order to investigate the linkage between reaching out to the older population segment, hypothesis ten is presented:

**H10:** An increased mobility and accessibility is required to reach out to the increasingly ageing population customer group

This chapter has discussed eHealth and its relation to mobility aspects. The correlation between interoperability and mobility is being considered as well as what impact security and privacy aspects has for the continuing development of mobility services in health care. Then follows a discussion about what desires both users and providers have of health care in terms of mobility and accessibility. Lastly, the chapter sheds light on whether increased mobility is seen required in order to reach out to the gradually ageing population and the importance of making sure that this customer group will have access to it.
4.4 eHealth in relation to business modeling

In pursuit of identifying theoretical guidelines of how business modeling could be supported and designed to be value-creating for the development and implementation of eHealth services, it became evident that clear associations between the two subjects is a multilayered task. A business model should furthermore include aspects from every affected user in every segment. Commonly, there are values of business models that are highly focused on economical- and technological factors in terms of activities generating value from within the company, while in the case of eHealth services, a more holistic approach involving the society as a whole is seen necessary (Boddy et al. 2009). Evidently, in for-profit contexts, these types of values are often purely monetary, but other kinds of non-financial value drivers are seen to be equally imperative, especially in health care environments, as health care is a special type of market (Limburg, M et al. 2011). It is therefore crucial to also identify value from an individual perspective such as e.g. patients, doctors, GPs and citizens, which further clarifies why a multi-user perspective is seen relevant to adopt for this master thesis. Bringing these aspects into consideration when scrutinizing objectives of business models, commercial cases, yet again, mostly strive for value in terms of purely monetary gains, while in cases of eHealth implementation, value needs to be observed and identified from a broader socio-economic perspective (Limburg, M et al. 2011). Implementing or enhancing an EHR-system could for example prove equally as important in relevance to nurses, doctors and GPs utilizing the new system as for patients where increased customer satisfaction could be an outcome due to subsequent lowered time spent in hospitals. Business modeling is further said to endorse a value-driven dialogue and encourages an enhanced understanding of what should be accomplished when implementing or improving eHealth services. Hypothesis eleven, $H_{11}$, is therefore formulated as:

$H_{11}$: Non-financial value-drivers should have a comparable impact as purely financial value-drivers when making decisions within health care

As a part of business modeling, it is customary to moreover apply a so-called impact analysis. The analysis is a key part of the continuing process of business modeling in order to understand operational outcomes related to the introduction of a specific eHealth service. The impacts are further often divided into internal- and external benefits where in the case of eHealth and health care in general, intangible elements are frequently present in addition to financial terms as previously mentioned. When one is refereeing to internal elements of an eHealth service implementation, the benefits are often correlated with activities within the health care organization such as:

- Decrease in clinical errors
- Lowered time of patients being hospitalized
- Increased efficiency of documenting and executive reporting by health professionals
- Enhancement of the image/brand of a overall health care organization

Whereas external benefits instead could refer to socio-economical outcomes such as:

- Electronic delivery of test results causing a reduction of transportation costs- and time
- Less anxiety and decreased stress levels for the patients
- Patients feeling an increased credibility and trust towards the general health care security
It is also considered relevant to shed light on the several categories of stakeholders associated with eHealth such as patients, health care organizations and providers, as well as policymakers, insurers, home care workers and employers, which all play an important role in business modeling of eHealth services (Wang, S, 2003). Every eHealth service is thus also claimed to have its own distinctive stakeholder network or ecosystem as it sometimes is referred as, that defines probable customer segments and necessary infrastructures for successful value co-creation of an eHealth service (Wang, S, 2003). It is also argued imperative not to ignore the patient as a stakeholder, since they often both have legal and social rights to participate in an eHealth development (Limburg, M et al. 2011). Bearing these aspects in mind, hypothesis twelve, H12, is hence formulated as:

**H12**: The opinions of patients and citizens should have equal impact as any other stakeholder when developing the future health care

Authors from the literature also repeatedly mention how a common barrier when trying to combine business modeling with eHealth, is how it is commonly challenging to pioneer and introduce a business-like philosophy in the field of health care. As the focus in health care always should be to prioritize the well-being of the patient, where maximizing the financial revenue is more associated to traditional business modeling, a prioritization collision appears (Limburg, M et al. 2011). Nevertheless, as the health care is progressively facing new complications, a business-like philosophy is reasoned to be essential in order to keep sustaining affordability and quality in future health care.

Chapter 4.4 have discussed important aspects when interpreting eHealth services from a business modeling perspective, where it is unanimously agreed how health care can not only be measured in purely financial results, but a more socio-economic approach is also necessary. It is further explained how an impact analysis is often applied to determine which internal and external benefits an eHealth service could contribute with, where intangible elements could be as important as monetary gains. Lastly, one should not ignore the important role a patient should have as a stakeholder among all other actors when trying to implement a business oriented mindset in today’s health care.

### 4.5 Summarized and comprised theoretical framework

As it now should be apparent, there is an abundant of aspects that is seen crucial to consider when developing new eHealth services as well enhancing existing ones. Readers of this master thesis should by now expectantly be acquainted with the four different theoretical concepts of the study’s framework being: eHealth in relation to interoperability, eHealth in relation to security, eHealth in relation to mobility and eHealth in relation to business modeling. An overall comprised framework of identified aspects that are seen most important in relation to eHealth development are presented in Table 1 on the following page. For every concept, a set of hypotheses has subsequently been constituted, which are listed in Table 2 in the forthcoming pages.

The concise framework will act as an overview for the reader to recap important and influencing aspects for every individual concept with associated hypotheses. The framework and hypotheses are to be empirically strengthened and later used as foundation for the analysis chapter (Chapter 5). The authors of this master thesis believe an advantage of using a multi-approach of different theoretical concepts is if unexploited aspects or issues are not discussed in one of the concepts, they might instead be revealed in another concept, as the different frameworks are somewhat interrelated to each other.
<table>
<thead>
<tr>
<th>eHealth in relation to interoperability</th>
<th>eHealth in relation to security</th>
<th>eHealth in relation to mobility</th>
<th>eHealth in relation to business modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship between technology and human interaction</td>
<td>Obscuring sensitive medical information - lack of confidence of EHR systems</td>
<td>Mobility is strongly affected by interoperability- and security aspects</td>
<td>Non-financial value drivers are considered equally imperative</td>
</tr>
<tr>
<td>Simplifies access to longitudinal medical records</td>
<td>eHealth - bringing new risks to patient integrity</td>
<td>Correlations between security aspects and current vs. future use of mobile devices</td>
<td>Importance of individual value identification</td>
</tr>
<tr>
<td>Reduction of medical errors</td>
<td>Patient awareness of underlying security</td>
<td>Sought after desire of increased mobility by patients</td>
<td>Activates within health care organizations</td>
</tr>
<tr>
<td>Delivery of area-specific terminology</td>
<td>Health care professionals’ awareness of underlying security</td>
<td>Sought after desire of increased mobility by health care professionals</td>
<td>Socio-economical outcomes</td>
</tr>
<tr>
<td>Valuable outcomes for both health care providers as well as the patients</td>
<td>Complex applications in varied settings with sufficient security levels</td>
<td>The health care infrastructure is challenging to alter and transform</td>
<td>Distinctive stakeholder network – crucial not ignoring the patient as a stakeholder</td>
</tr>
<tr>
<td>Administration and documentation issues</td>
<td>Abuse of medical information – audit trails</td>
<td>Eliminating in-patients care fees</td>
<td>Implementing a business-like philosophy in the field of health care</td>
</tr>
<tr>
<td>Costly upfront investments in correlation to long-term ROI</td>
<td>Relying on a secure and stable Internet connection</td>
<td>Upholding a equity perspective - reaching the ageing customer segment</td>
<td></td>
</tr>
<tr>
<td>Incentives from governments are seen necessary to overcome start-up costs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 - The comprised theoretical framework, where identified and influential aspects seen to affect the development and implementation of eHealth services, have been summarized. This framework is to be used as a foundation for the chapter 5, the empirical analysis. If the reader considers any aspect hard to interpret, they are more thoroughly elucidated in their respective sub-chapter in the previous pages
5 Analysis of empirical gatherings

This chapter will present the empirically gathered qualitative data from the ten in-depth semi-structured interviews and the two case studies. The gathered empirics have been deciphered and interpreted here in relation to its relevancy for the thesis and the objective of the study. The chapter further aims to analyze the empirically gathered information from the interviews as well as case studies and comprehend how the findings both can be related to the previously stated hypotheses as well as in conjunction to the comprised theoretical framework. The chapter lastly enlightens the findings from the case studies where the BMC framework has been utilized alongside with an impact analysis with relations between the prominent aspects and the benefits identified from each impact analysis.

As can be seen from the comprised theoretical framework, see Table 1, a set of key aspects has been identified, all somehow being related to each of the four theoretical concepts. Every concept and thus every aspect has been, as previously explained, obtained from an abundant of mostly up-to-date scientific articles, in order to unearth often recalled issues from the current healthcare. During the empirical inquiry, copious data has been gathered in relation to the theoretical concepts, adhering to both health care professionals of different sorts, as well as citizens and patients in the Swedish health care.

In this chapter, a recap of each of the hypotheses from the previous chapter will firstly be comprised on the following page in table 2, with the intention of simplifying for the reader. The structure of this chapter will be similar to the structure of the previous chapter (chapter 4 - Theoretical framework), where every concept is to be presented together with its associated aspects from the framework. Each and every hypothesis will then be verified with the support of the gathered data from the interviews, as well as discussed and analyzed by the authors of the thesis. After every hypothesis related to each theoretical concept has been verified, each associated sub-chapter will be summarized, and the most prominent aspects highlighted in a cutout framework-section acting as an answer to RQ1 (see chapter 1.4). At the end of each section associated to a theoretical concept, the identified aspects found to be the most prominent will be comprised in a sub-chapter called “Conclusive summary of the section” with the intention of recalling for the readers.

After every theoretical concept and each related prominent aspects have been brought up, the analysis chapter will introduce a completed Business Model Canvas (BMC) framework for the two case studies that has been carried out. The case studies were carried out at Skärholmens ÖNH Centrum and at Karolinska Universitetssjukhuset and both of the case studies are more methodically explained in chapter 5.5.1 and chapter 5.5.2. The two BMCs will then be analyzed and discussed alongside an impact analysis, which addresses the internal and external benefits from the case study victims, as both has implemented an eHealth services that brought major changes to their businesses, which in these cases was a switch of EHR-system. The findings of the impact analyses are then to be related to the identified most prominent aspects of the first part of this analysis chapter, which constitute what will be an answer to RQ2. All of the findings are then to be further discussed in chapter 6, Discussion.

Throughout the analysis chapter, references to certain information gathered from the interviews are to be presented as something that the interviewee said, for example “Interviewee One argued how…” in order for the text to be as fluent as possible for the reader. When quotes are used, each quote will be separately written followed by a name inside a bracket to clarify who expressed themselves. A more thorough explanation of each interviewee and asked questions can also be found in Appendix B and C at the end of the thesis.
H1: Both technical and social interoperability is equally imperative for the health care

H2: Increased interoperability is a prime driver for health care professionals to better perform diagnostics on their patients

H3: Increased interoperability has led to excessive time spent with administrative work and documentation for health care professionals instead of devoting the time interacting with the patient

H4: Increasing the interoperability in the health care directly results in monetary gains

H5: The evolving wave of eHealth services is alleged presenting new security risks, which could jeopardize patients' medical records

H6: Patients, citizens and health care professionals are well aware of the underlying security of today’s EHR systems and how health records are being managed

H7: Internet connectivity is today functioning well and is not considered being an Achilles heel in terms of security among health care facilities

H8: Interoperability and security aspects are considered being what primarily limit how mobile the health care can become

H9: There is a sought after desire both from patients, citizens and health care professionals for an increased mobility associated to both received and provided health care

H10: An increased mobility and accessibility is required to reach out to the increasingly ageing population customer group

H11: Non-financial value-drivers should have a comparable impact as purely financial value-drivers when making decisions within health care

H12: The opinions of patients and citizens should have equal impact as any other stakeholder when developing the future health care

Table 2 - Hypotheses developed from every individual section of the theoretical framework
5.1 Interoperability

This chapter presents and analyzes whether the hypotheses related to the interoperability aspects, see table 3 either are true or false. At the end of the chapter, discussed aspects are summarized and the most prominent are finally highlighted in the chapter's closing table 4.

<table>
<thead>
<tr>
<th>eHealth in relation to interoperability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship between technology and human interaction</td>
</tr>
<tr>
<td>Valuable outcomes for both health care providers as well as the patients</td>
</tr>
</tbody>
</table>

Table 3 – Key aspects identified from “eHealth in relation to interoperability”, gathered from the theoretical framework (chapter 4.5)

**H1**: Both technical and social interoperability is equally imperative for the health care

When asking the interviewees about their opinions of interoperability in the health care, it became clear how there were ambiguous associations towards the term. A majority simply related the term to how systems functioned and communicated with each other as interoperability includes *inter*, meaning “between”. Many interviewees further recognized the meaning and difference of the social- and technical interoperability, but had seldom correlated it to a specific term. However, it rapidly became clear how the interviewees believed EHR-systems greatly lacked a pedagogical interface and most aspects that could be linked of being intuitive. Aron Sobin, doctor and manager at Skärholmens ÖNH-centrum, spoke of how EHR-systems furthermore often have a steep learning curve and that many of today’s older and more experience doctors are not as accustomed to the modern IT world, but has over time learned and begun to realize how obsolete the current EHR-systems actually are and become quite dissatisfied.

“There is an abundant amount of work left to do concerning EHR-systems, particularly with the user-interface”
- Aron Sobin

Sofie Zetterström, deputy CEO on Inera, argued about the importance of informatics, especially in the health care as it is imperative to make sure one means the same thing when using different concepts, which she sees as a keystone for information to be transmitted correctly among the users. She further argued how social interoperability is principally a “quality and security parameter” in order for the health care to function properly. Johnny Sobin, doctor and IT-responsible manager at Skärholmens ÖNH-centrum, also agreed that EHR-systems are not intuitive and how several functions are not entirely obvious for the user. He believed that the problem today does not lie in the technical part, but in the social part, as the systems are not made to be easily understood. One possible root explanation for this lack of social interoperability, which was raised by several interviewees, is how the developers of EHR-systems are often owned and evolved by IT-personnel, as the systems are their tools. The eHealth development seems to end up at the IT department, having no real connection to the actual health care professionals, and it unfortunately shows in terms of
deficient user-interfaces. Aron Sobin further believed how the system TakeCare having grown so rapidly, also has made it troublesome to keep up with all the demands from the system’s unique users.

"It is clearly obvious how the TakeCare EHR-system is not designed for us doctors"
- Johnny Sobin

Lastly, both Maria Kyhlbäck, physiotherapist at Akademiska sjukhuset using the Cosmic EHR-system in Uppsala and Ingrid Fröberg, doctor and GP at Edsbergs health center utilizing the TakeCare system, expressed how, apart from the systems not being self explanatory and requires a lot of time learning to use them, the technical interoperability of the systems are not optimal either. Maria Kyhlbäck told how the EHR-system Cosmic occasionally crashed and Ingrid Fröberg spoke about how there are still many desired technical functions.

"There are a lot of administrators occupied with their own systems in their own little worlds and that is not how it should be as it vastly complicates everything. When one is implementing a new system, one must also align it with the profession, otherwise the systems will keep being non user-friendly as they are today"
- Ingrid Fröberg

As the thoughts and opinions from several interviewees using EHR-systems on a daily basis, all expressed dissatisfaction in terms of user-interface, which can be associated to social interoperability, hypothesis one can therefore be considered of being true.

**H2: Increased interoperability is a prime driver for health care professionals to better perform diagnostics on their patients**

When discussing whether increased interoperability only would result in positive changes, it was unanimously considered among the interviewees how increased interoperability in the long run would undoubtedly bring positive outcomes. There was however no common thread in terms of *what* and *how*. Aron Sobin, having both experiences from his time at Karolinska Universitetssjukhuset as division manager among other roles, and now as a doctor at Skärholmens ÖNH-centrum, desired a better connected network primarily in Stockholm and later nationally. He believed it would aid the care practitioners to work more effectively and thus offer a health care of higher quality. He also mentioned how it today is far from satisfactory in terms of how doctors and nurses document in the EHR-systems, and how an increased interoperability would very likely facilitate the administrative work. Some sort of dictation system could be a possible solution according to Aron, but he also stressed the importance of being able to document himself as it both lowers mistakes in terms of e.g. typos compared to if someone else would write the record, and it would also be comforting to know that a medical record has actually been uploaded if he writes it himself.

"TakeCare has provided a faster and easier management of patient cases, and thus a more effective and perhaps safer health care. You avoid a lot of duplication work and it is likely also cost-saving"
- Ingrid Fröberg

During the interview with Helen Ferm, a former nurse and now a software engineer with a lot of experience from eHealth development in Sweden, she expressed how she was certain of how increased interoperability would only induce positive impacts such as initially enhanced integrations of EHR-systems, which would subsequently lead to something that is always highly sought after: more quality time spent with the patients. Ingrid Fröberg further
mentioned how their transition from their previous EHR-system to TakeCare has already paid off in terms of a faster and simpler health care for patients. She can nowadays avoid duplication work and the diagnostic and decision times have become quicker. Johnny Sobin and Sofie Zetterström also supported the beneficial aspects increased interoperability would bring, as daily work routines would most likely be more efficient and of higher quality. Sofie Zetterström additionally argued about the difficulties that the national patient overview module called NPÖ still has to tackle; a function said being a long-term solution to nationally improve the interoperability in Sweden. She reasons how the function has no real incentives or requirements regarding the content, apart from the technical relation and the concept will have to be reconsidered in order to be beneficial and economically viable.

"NPÖ is a separate colossus that lies alongside all other infrastructure services and is also extremely substantial and expensive"
- Sofie Zetterström

Johnny Sobin further used radiology images as an example, as he today directly can receive results and therefore more efficiently give an accurate diagnosis, as there exists a direct link towards the radiology, something that should exist for each and every department of the health care. However, it became clear that there was a unanimous view of how increased interoperability would solely have positive impacts and thus being a prime driver for the health care, which strengthens why hypothesis two is true.

**H3:** Increased interoperability has led to excessive time spent with administrative work and documentation for health care professionals instead of devoting the time interacting with the patient

When bringing up the subject of the time spent with administrative work and documenting, all of the interviewees had a lot to express. An outright common response was however how resoundingly agreed everyone was that the documentation have gotten out of hand and how a health care professional spends far too much time in front of the computer documenting instead of interacting with the actual patient. Ingrid Fröberg was one among several of the interviewees that argued how doctors spend much more time documenting today compared to before, including herself. Ingrid Fröberg believed how the personnel at Edsbergs health central have gone from documenting approximately 10 % of the total time, while today it is closer to 50 %. She further expressed how it somehow feels as the documentation has become forced, and that it steals precious time that otherwise could have been spent with the patients. It should also be noted that she does not either see where all of the added layers of documentation will lead to, which is a recurring judgment from other interviewees as well.

"I think we need to spend more time doing what we actually are trained to, namely the patients and actual health care, rather than spending so much time with administrative work and documentation"
- Ingrid Fröberg

However, as hypothesis three aims to answer if increased interoperability is the thief in the context why the documentation has increased over the years, it emerged from several interviewees that it was most likely not, but on the contrary instead. Many interviewees argued how it is the ever-changing laws and regulations from the National Board of Health and Welfare in Sweden, as well as the requesting counties that constantly requires new types of information that doctors and nurses need to document. A more interconnected EHR-system would in fact partially liberate the problem of duplication documentation in accordance to Johnny Sobin, but it will not solve the root cause of the National Board of Health and Welfare
demanding more and more information. He did not see what all of the documentation would lead to, and the situation becomes even further complex as the time spent documenting seems to be even of a graver problem among the nurses according to Aron Sobin and Maria Kyhlbäck. They document their own journals that have no or little communication with the ones of the doctors and add no real future value, but instead waste a lot of time and effort.

Aron Sobin and Johnny Sobin also did not see a correlation between increased interoperability and increased time spent documenting, as they likewise directed the problem source of coming “from above” and being union demands. Johnny Sobin argued how the EHR-system transition to TakeCare at Skärholmens ÖNH-centrum in fact has made documenting faster, but the amount to document itself is too much and sometimes also feels irrelevant. Sofie Zetterström commends the use of search- and keywords as well as templates among general enchantments of EHR-systems to facilitate the documentation, which is also something Aron Sobin saw as a possible solution in order for doctors to both take part of the additional documentation that nurses today conduct as well as generally streamline the whole documentation process.

"Half the time I devote with a patient, I spend documenting the actual event”
- Johnny Sobin

“We doubt within the union if the National Board of Health and Welfare really will have any benefit from all the information they collect. I do not believe it anyway. Until the day a riot occurs, the National Board of Health and Welfare will find additional parameters that we will need to document”
- Johnny Sobin

Lastly, Eric Wahlberg, business unit director at Praktikertjänst AB, brought up another interesting aspect, which he thought had a big impact, which he referred to as being the alternative use of concepts in the health care. He argued how there is one customer group who are civil servants and then there is a group that are more directly involved in the health care and these two groups speak totally different languages, and therefore causes a dilemma.

In terms of hypothesis three, increased interoperability cannot be said to having induced an increased and excessive time spent documenting for health care professionals, but rather having to do with new and changing laws and regulations. Hypothesis three can therefore be said to be false.

H4: Increasing the interoperability in the health care directly results in monetary gains

When trying to unearth an answer to whether increased interoperability in the health care has any direct connection on monetary gains, it quickly became clear from the interviewees how there is a major difference between the private health care sector and the public health sector. Within Praktikertjänst who conducts their business on the private health care market, there often is a developed knowledge- and understanding perspective of how money and ones business work together, as the incentives are aligned. You basically have to listen and adapt to your patients desires and your county as employer in order to survive, while the public health sector would most likely save money in terms of resources and time if the interoperability among other factors would be improved according to several interviewees.

Aron Sobin further argued how basic tasks such as walking to collect a journal, sending, posting, faxing or scanning reports and especially spending time looking for medical records, are aspects where one could save time and ultimately money.
“Time savings and improved communication will lead to increased profits”

- Aron Sobin

Sofie Zetterström also believed how an increased interoperability in the public health care would ultimately lead to more efficient ways of conducting everyday work that would free up more time for other tasks, which in the long-run most likely would save money. Ingrid Fröberg additionally saw how increased interoperability would have a positive impact in relation to lab-departments and other diagnostic facilities as duplication tests and response times could be lowered, which would save money.

The authors of this thesis believe that the responses related to hypothesis four are too vague to alone suffice to present a credible answer. None of the interviewees could further present actual figures that would strengthen the final verdict for this hypothesis. It was however revealed that a majority of the answers of the interviewees felt that the public health care would most likely benefit from an increased interoperability in relation to monetary gains, but how it is more about time- and resource savings than an increased income. Hypothesis four is therefore still considered to be unanswered and would require more research.

5.1.1 Conclusive summary of the section

Firstly, it became evident from the analysis how EHR-systems greatly lack a pedagogical interface and often have a steep learning curve, as many of its users expressed opinions of dissatisfaction. It was further acknowledged how important it is that informatics and terminology must be delivered correctly as it is considered as a quality and security parameter in the health care, where templates and keywords should be prioritized and implemented more efficiently. Apart from the notion of EHR-systems not being easily understood by the end-users, thus lacking social interoperability, the technical interoperability was also considered to have potential of improvement as desired features are still absent and modules sometimes crash.

Whether increased interoperability could be seen as a prime driver for improving the health care, it was unanimously agreed how health care professionals would benefit from more effective work processes, which would offer a more high-quality health care. It also became evident how aspects as more quality time spent with patients, avoiding duplication work, lowering waiting and lead times as well as the weight of doctors documenting medical records themselves all had valuable associations towards increased interoperability. Additionally, the ratio between patient time and administrative work, the latter one have been agreed to take increasingly too much time, but not being related to increased interoperability but to ever-changing laws, regulations and demands from the National Board of Health and Welfare in Sweden. EHR-systems with increased interoperability have on the contrary in fact facilitated the documentation process in accordance to some interviewees.

Furthermore, it became apparent how questions regarding monetary gains would have bigger impact on the public health sector compared to the private, although in terms of time- and resource savings rather than higher incomes. Lastly, aspects being related to government incentives and costly start-up investments might not have an extensive impact as they were never or very seldom brought up during the empirical investigation.

Consequently, the three most prominent identified aspects shaping the development of eHealth services in Sweden often mentioned and influenced with regards to “eHealth in relation to interoperability” are therefore judged to be (1) Relationship between technology and human interaction, (2) Administration and documentation issues and (3) Simplifies access
to longitudinal medical records, see Table 4. All of the three aspects are interrelated and will be further discussed in “Chapter 6 – Discussion”.

<table>
<thead>
<tr>
<th>eHealth in relation to interoperability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship between technology and human interaction</td>
</tr>
<tr>
<td>Valuable outcomes for both health care providers as well as the patients</td>
</tr>
</tbody>
</table>

Table 4 – The most prominent aspects seen influencing eHealth services from an interoperability perspective

5.2 Security

This chapter presents and analyzes whether the hypotheses related to the security aspects, see table 5 either are true or false. At the end of the chapter, discussed aspects are summarized and the most prominent are finally highlighted in the chapter's closing table 6.

<table>
<thead>
<tr>
<th>eHealth in relation to security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obscuring sensitive medical information - lack of confidence of EHR systems</td>
</tr>
<tr>
<td>Complex applications in varied settings with sufficient security levels</td>
</tr>
</tbody>
</table>

Table 5 - Key aspects identified from “eHealth in relation to security”, gathered from the theoretical framework (chapter 4.5)

**H5: The evolving wave of eHealth services is alleged presenting new security risks, which could jeopardize patients’ medical records**

The theoretical framework enlightened how the whole eHealth movement of offering more mobile services and letting patients have increased access and control over their medical records also subsequently would entail new security risks that would need to be addressed. Having spoken to two professionals who are closely working with security and identification aspects within the Swedish health care, it was revealed how they saw future risks in services associated to personal medical information becoming more mobile.

Kerstin Arvedson, chairman in the SITHS management group, a national security solution in Sweden operating with electronic identification (see chapter 3.2.2), argued how she believed there being a threat in the request where everything should be as easy as possible for the users. A manager for HSA in Stockholm county council, an electronic catalog that includes quality secured information about individuals, functions and units within Sweden’s
municipalities, counties and private providers, additionally assessed how cumulative mobility among other aspects in relation to eHealth services would most likely also introduce new security risks. The interviewee especially saw a need in reviewing the shell security with a focus on how one provides access to private information to the patient.

Alongside the debate of patients becoming able to own and have access to their entire medical record, Kerstin Arvedson also highlighted how important it is not to neglect the hazards of being able to do so with the help of mobile devices. She emphasized the importance of making sure that the entire line of security-modules are assured to e.g. avoid leakage of medical information even though the identification process is considered secure on a mobile device, but the webpage accompanying the operative system might not be protected.

“The real debate is about whether the patient should have access to their own medical records from their homes. This could lead to security issues. How will we really be able to assure the identity of the person logging in? Is it actually the patient sitting at the computer?
- Aron Sobin

Other interviewees uttered how they believed new security risks always would emerge, but at the same time they considered the security standards in the Swedish health care of being at the forefront compared to many other areas, as a majority of the information is encrypted. The perception of today's EHR-systems was also noticed that it felt secure, and thought that the eHealth wave will have a marginal security impact. Annika Svedberg, pharmacy and quality manager at Apotek Hjärtat did further not express any distress in relation to their forthcoming eCommerce service, as she argued how security aspects always have been prioritized and also drew parallels to their standards being compared to the ones used among banks.

Ingrid Fröberg however voiced a concern towards the patients being able to take part of their medical records, as she believes it should, if necessary, be accompanied with explanations from health care professionals. Helen Ferm on the other hand deemed the whole security issue in the current health care alleged of being far too excessive, which could be interestingly correlated to Eric Wahlberg’s opinion as he thought the security issue is somewhat already deciphered if you change the field perspective towards the banks. Lastly, Sofie Zetterström from Inera judged how the trend in the society is moving more and more towards how no one longer cares whether certain information is being distributed or not as there is openness in today's healthcare.

"I believe that most of the security- and privacy issues will be resolved- if you think about banks for example, they have managed the privacy issues so why can’t we in the health care business do the same? Also, I would prefer to have some one find out about my social security number rather than stealing my money on my bank account"
- Eric Wahlberg

Recapping the analysis of whether the undergoing and forthcoming eHealth movement is alleged to present new security risks, it can be concluded how there is a unanimous judgment of the hypothesis being true. It should however be noted that the impact of these new and alleged security risks is of minor concern as the current security standards are highly developed and how the whole debate in fact could be overemphasized.

H6: Patients, citizens and health care professionals are well aware of the underlying security of today’s EHR-systems and how health records are being managed
When investigating whether there existed a general knowledge of the underlying security in the Swedish health care related to the EHR-systems, it could quickly be established how the knowledge was practically non-existent, both in terms of patients and citizens as well as health care professionals. Regarding the patients, it was revealed that virtually no patient ever asked questions about how the EHR-systems worked or how their medical records were distributed, apart from cases where the patient did not want their personal information to even be stored in the systems due to particular circumstances. Both Johnny Sobin and Aron Sobin argued how the patients are not interested in the underlying security when they visit a doctor, as they blindly trust that the visit is classified and the systems safe and solely want the medical consultation.

"Security belongs to the infrastructure, it is not interesting for the patients to know"
- Kerstin Arvedson

Sofie Zetterström interestingly spoke of how the trust towards today’s health care is so high and sometimes perhaps higher than justified, which could be a reason why it does not exist any real doubt towards the usage of medical records. It was also noteworthy to hear that the same levels of trust were also found among the customers of Apoteket AB, which much likely had much to do with how closely related they are to the health care. The perception of how a majority of the patients today instinctively trust the security in the Swedish health care seemed to have high generalizability, but will however probably slowly begin to change in conjunction with patients and citizens obtaining an increased influence of their own health care in the near future. The information-society is deemed to naturally keep growing, which will influence why the responsibility of information and associated security will be prioritized and receive higher focus and will ultimately require patients to be more interested, which was more deeply discussed with a HSA-manager from SSL.

"The patient will in the future be more controlling and demaning over what medical information the health care will have access to and this will also increase the quality of the medical information"
- SSL HSA-manager

As for the knowledge of the health care professionals, the awareness was likewise very limited. It was also expressed how some believed these types of questions being tedious and have “always functioned” so they felt no need of suddenly spending time updating themselves on security while other only asked questions when a system-function had stopped working. There was however a universal knowledge of what sorts of actions you as a health care professional should not execute in order to get caught in audit trails and logs. This hypothesis could therefore be said being false.
**H7:** Internet connectivity is today functioning well and is not considered being an Achilles heel in terms of security among health care facilities

As health care facilitates in most cases have their own Internet connection in order to guarantee an encrypted and secure connection, it was investigated whether health care professionals experienced any dissatisfaction that had any relation to the Internet connectivity. It was further discovered how no one expressed the Internet connection ever being a bottleneck or Achilles heel in terms of performing their everyday routines, which the SLL HSA-manager simply referred being because of very high and continuously developing requirements.

"The Internet connectivity is today not seen as a Achilles' heel, it is constantly being evolved"
- SSL HSA-manager

Aron Sobin, Ingrid Fröberg and Johnny Sobin further stated how the Internet connectivity have in their long careers extremely seldom crashed or malfunctioned, which to conclude must be considered as a very good proof of why this hypothesis is true.

**5.2.1 Conclusive summary of the section**

Regarding security aspects in relation to eHealth services it became evident from the empirical investigation how risks and pitfalls would emerge associated to patients medical records, as services will most likely become more accessible and mobile. Reviewing what is referred to as the shell security and how one provides access to private information to the patient, as well as making sure that the entire line of security modules is being guaranteed secured if services are to be used on mobile devices. However, the impact of these alleged security risks are considered marginal as the current security requirements and encryptions are very high and at the forefront in the Swedish health care. It was also argued how the whole security debate is far too excessive and perhaps partly solved if one investigates the solutions of the banks. Lastly, it was discussed how today’s society does not care as much as before if information is being distributed as there is a trend of openness towards the health care. In terms of knowledge related to the underlying security of EHR-systems and management of patient medical records, the awareness was practically non-existent. Lack of interest, blind trust (sometimes higher than perhaps justified) and prioritizing medical consultation were seen to be the reasons. However, the trend of patients and citizens having more influence and control of their own health care and journals is deemed of resulting in patients having to take more responsibility. As far as health care professionals are concerned, security knowledge has since long been seen as a tedious subject and not seen necessary unless something is malfunctioning. Finally, Internet connectivity was discovered not being a bottleneck or Achilles heel in relation to security and health care professionals everyday routines due to high and continuously developing requirements.

Consequently, the two most prominent identified aspects correlated to the development of eHealth services in Sweden often mentioned and of influence with regards to “eHealth in relation to Security” are judged to be (1) Patient awareness of underlying security and (2) eHealth – bringing new risks to patient integrity, see Table 6. The two aspects will be further discussed in “Chapter 6 – Discussion”.
eHealth in relation to security

| Obscuring sensitive medical information - lack of confidence of EHR systems | eHealth - bringing new risks to patient integrity | Patient awareness of underlying security | Health care professionals’ awareness of underlying security |
| Complex applications in varied settings with sufficient security levels | Abuse of medical information – audit trails | Relying on a secure and stable Internet connection |  |

Table 6 - The most prominent aspects seen influencing eHealth services from a security perspective

5.3 Mobility

This chapter presents and analyzes whether the hypotheses related to the mobility aspects, see table 7 either are true or false. At the end of the chapter, discussed aspects are summarized and the most prominent are finally highlighted in the chapter's closing table 8.

Table 7 - Key aspects identified from “eHealth in relation to mobility”, gathered from the theoretical framework (chapter 4.5)

<table>
<thead>
<tr>
<th>eHealth in relation to mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility is strongly affected by interoperability- and security aspects</td>
</tr>
<tr>
<td>The health care infrastructure is challenging to alter and transform</td>
</tr>
</tbody>
</table>

| H8: Interoperability- and security aspects are considered being what primarily limits how mobile the health care can become |

The inquiry of uncovering what aspects are considered limiting how mobile the health care can become, the responses from the interviewees predominantly had a joint opinion. It became obvious how today’s standards of interoperability, if being improved, would most likely cause the health care in the future to be more open and mobile in accordance to both Johnny Sobin and Ingrid Fröberg. Being able to perform daily work tasks in a simpler and more intuitive manner where often brought up as a sought after outcome associated with improved interoperability, whereas one should not forget the importance of the personal contact between the doctor and patient further argued by Ingrid Fröberg.
“I suspect that if medical records are to be fully revealed, some information will possibly be withheld, and instead might be documented on a paper journal. Although the medical record belongs to the patient, it is also the doctor's tool. Everything that is written in a journal may not be appropriate to be revealed without a comment or explanation from the health care provider. Personally, I will probably think twice before I document certain judgments or suspicions in order to really get my facts confirmed. I think one should think very carefully before publishing an entire medical record.”

- Ingrid Fröberg

An increased interoperability making it possible for patients to e.g. access their medical records through a mobile device from home also had its risks, as an additional and professional explanation should always be given to avoid misinterpretation of a diagnosis. Aron Sobin additionally enlightened how hospitals and health care centers now having a link to pharmacies is a great example of how improved interoperability has greatly boosted the mobility for the patient, as they are now able to freely go and collect medication from a pharmacy of their choosing without needing to bring a paper prescription. However, Aron Sobin further implied how increased interoperability in terms of adding connections to the Swedish health insurance fund and the public health insurance agency would foster an improved mobility for both the health care professionals and the patients, but how costly start-up investments most likely is a hindering factor.

It was further agreed how security parameters also hinder a more rapid evolvement of the health care in terms of mobile services. The identification tool SITHS is on itself regarded as a secure solution, but as a more mobile health care partly involves an increased utilization of medical data on mobile devices, the whole security package needs to be reviewed according to Kerstin Arvedson. The initial identification process might be secure, but if you do not have full control over the operative system of e.g. an iPhone or iPad, the usage of the web browser would be considered a security risk as it is totally open. It became obvious how it is crucial to have a holistic perspective before saying that something is considered secure. Helen Ferm additionally refereed to this dilemma of how the overall security standards need to be improved before we will see more mobile devices as platforms and recipients of personal medical information. Another interesting notion originated from Sofie Zetterström was how she talked about a trend in society of how citizens nowadays request more responsibility of ones own health care being e.g. performed at home with the aid of eApplications, which will force organizations to offer more mobile services.

"The health care is more and more at located at the patients home, which means that health services also need to be more and more mobile"

- Sofie Zetterström

As interoperability and security was frequently mentioned and also often the first issue they voiced as key drivers, hypothesis eight could be considered as true.

**H9:** There is a sought after desire both from patients, citizens and health care professionals for an increased mobility associated to both received and provided health care

Apart from interoperability and security criteria being seen as key drivers for how mobile the health care can become, it was additionally investigated whether mobile services associated to the health care is actually coveted from both the patients and citizens as well as the personnel working in the health care. However, the individuals exploiting the health care in Sweden, there was no recurring desire that any of the interviewees could think of. A smaller percentage
of Aron Sobins patients sometimes asked why recipes could not be entire received from their homes, as it would be more convenient according to some, where other wanted a remote examination to avoid expensive in-patient fees. Both Johnny Sobin and Ingrid Fröberg expressed how the typical patient in fact does not, quite naturally, want to reach the stage of even having to visit a doctor, and prioritizes the actual meeting with the doctor and receiving medication if necessary, instead of the experience being more mobile. Something that however was brought up by several interviewees was how an increased usage of mobile phones would be an appreciated supplement of receiving different sorts of information, where a representative from Apotek Hjärtat also concurred from having reviewed their customer panel.

"I believe the major future revolution in the health care is related to when the patient owns his or her own medical record and provides the health care with the permission to read it and not vice versa"

- Eric Wahlberg

If instead switching perspective towards the health care professionals themselves, Aron Sobin expressed that apart from doctors most likely would benefit from being able to login to an EHR-system when they are working on duty in order to better grasp the overall patient status instead of having it explained through a phone call, he argued that he did not believe that a majority of today’s doctors desired more mobility. If health care professionals could be reached in additional ways due to increased mobility, patients would most likely have too many ways of reaching the doctors, which would be counter-productive and wearisome if it is not an emergency according to Johnny Sobin. One should instead prioritize to lower the time required of todays health care professionals to spend on documenting instead of introducing new ways of offering mobile health care, so more time could be spent with the patients according to Johnny Sobin. It was also, yet again, reasoned important not to forget the personal contact that could become deficient if health care professionals would start to spend more time in a remote medium, causing the patient to misjudge received diagnoses.

Based on the opinions and knowledge expressed from the health care professionals regarding both themselves and their perception of today’s patients, no clear desire of an increased mobility was distinguished. The hypothesis is therefore argued to be false.

**H10:** An increased mobility and accessibility is required to reach out to the increasingly ageing population customer group

Whether the ageing population in today’s society will be hard to reach out to if the mobility and accessibility is not increased, the unanimous beliefs of the interviewees were considered being that it will always be very hard to communicate with this customer segment and that improving the mobility may not be a prerequisite. It could quickly be established how each and single interviewee judged the debate of reaching out to the elderly in the society to be principally a generation issue. Johnny Sobin argued how he believed the ageing population segment becoming increasingly IT mature and one should not be amazed seeing patients 70 years old managing bookings online. However, Johnny Sobin did also claim that he did not see how introducing new and more mobile services would intuitively benefit reaching the elderly, as they often are not as approachable towards new functions and do not want to change old habits. Similarly did Aron Sobin assert that changing the ways health care today is being distributed in order to become more mobile would take very long, and considered enhancing the efficiency by getting EHR-systems to work together would instead have favored the elderly segment than introducing more mobile services. He also concurred that general IT and Internet usage would become common tools among the elderly and should not
be seen as a concern. Making sure that the majority of the older Swedish population instead has access to a highly developed broadband connection should although be prioritized, as future eHealth services will somehow be totally dependent on it to avoid segregation dilemmas in accordance to Helen Ferms predictions. Marianne Norelius, working with management Health Strategies at Apoteket AB in Sweden, further elucidated how they do not see that Apoteket AB is in need of new means of communication in order to reach out to their elderly customers, but instead should incrementally improve how they communicate today.

"An increased mobility will liberate resources of people who, on their own, strive to take care of themselves"
- Sofie Zetterström

It should also be noted that some interviewees expressed concern for a scenario where the health care is moving too fast in introducing new services that ultimately would replace currents ways of offering health care. One must respect that it will exist an elderly patient segment that always will refuse changing and therefore it could be necessary to offer, during a transitional period, two types of parallel health cares until a generation change has occurred.

As the undisputed judgment consequently appears to be that it all comes down to a generation issue where the elderly naturally will have to adapt instead of introducing new mobile services, this hypothesis is therefore argued to be false.

5.3.1 Conclusive summary of the section
The mobility framework initially shed light on how improved interoperability most likely would lead to simpler and more intuitive outcomes related to health care professionals work routines, where networks between hospitals and pharmacies was brought up as an illustrative example. It was also discussed how linkage to the Swedish health insurance fund and the public health was sought after and would result in improved mobility for the patients and health care professionals. However, several expressed concern that too much mobility too soon, such as patients being able to read their own medical record at home could be a risk if no professional health explanation also would be given to avoid misinterpreting a diagnosis.

It was also showed how one would most likely have to review the whole security package if private medical information were to be accessed on mobile devices, as the identification process being secure is not enough due to e.g. the web browser of an operative system being open to the world.

It was further identified how no recurring desire of wanting the health care being more mobile could be extracted from the patients according to the experience of health care professionals, apart from receiving recipes from home or obtaining information on mobile devices in greater extent. Patients additionally seemed to prioritize keeping a personal contact with his or her doctor. Whether health care professionals themselves sought a more mobile health care, the concern of being reached from patients too easily if not being an emergency was a frequent argument why it was not particularly pursued.

Lastly, increased mobility was argued not being the obvious solution in order to reach out to the ageing population in today’s health care, as it is more considered as a generation issue. Elderly people will naturally adapt and are already using IT and Internet to a larger extent than before. Offering two parallel health care systems until a generation change has occurred could also be necessary to respect the ones not wanting to change.

Consequently, the two most prominent identified aspects correlated to the development of eHealth services in Sweden often mentioned and of influence with regards to “eHealth in
relation to mobility” are judged to be (1) Interrelation between interoperability/security and mobility and (2) Correlations between security aspects and current vs. future uses of mobile devices, see Table 8. The two aspects will be further discussed in “Chapter 6 – Discussion”.

<table>
<thead>
<tr>
<th>eHealth in relation to mobility</th>
<th>Sought after desire of increased mobility by patients</th>
<th>Sought after desire of increased mobility by health care professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility is strongly affected by interoperability- and security aspects</td>
<td>Correlations between security aspects and current vs. future use of mobile devices</td>
<td>The health care infrastructure is challenging to alter and transform</td>
</tr>
<tr>
<td>The health care infrastructure is challenging to alter and transform</td>
<td>Eliminating in-patients care fees</td>
<td>Upholding a equity perspective - reaching the ageing customer segment</td>
</tr>
</tbody>
</table>

Table 8 - The most prominent aspects seen influencing eHealth services from a mobility perspective

5.4 Business modeling

This chapter presents and analyzes whether the hypotheses related to the business modeling aspects, see table 9 either are true or false. At the end of the chapter, discussed aspects are summarized and the most prominent are finally highlighted in the chapter’s closing table 10.

<table>
<thead>
<tr>
<th>eHealth in relation to business modeling</th>
<th>Activates within health care organizations</th>
<th>Socio-economical outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-financial value drivers are considered equally imperative</td>
<td>Importance of individual value identification</td>
<td>Activates within health care organizations</td>
</tr>
<tr>
<td>Distinctive stakeholder network – crucial not ignoring the patient as a stakeholder</td>
<td>Implementing a business-like philosophy in the field of health care</td>
<td>Activates within health care organizations</td>
</tr>
</tbody>
</table>

Table 9 - Key aspects identified from “eHealth in relation to interoperability”, gathered from the theoretical framework (chapter 4.5)

H11: Non-financial valueDrivers should have a comparable impact as purely financial value-drivers when making decisions within health care

Perhaps not surprisingly, it was undisputed how values not directly associated to incomes and monetary gains should not be ignored. The dilemma lies in whether how much they actually influence when business modeling in the health care. Sofie Zetterström claims how it is important to streamline the health care systems in order to free resources of the groups needing it the most, which subsequently saves time. She further established that increasing the quality in the health care and making it more consistent are important value-drivers, as well as developing knowledge and support services for the sole purpose of ensuring a high quality health care. Sofie Zetterström ultimately claimed that saving time and ensuring quality is more important than just making money in the health care, as it always should be. However,
hospitals and medical directors are sadly to an excessive degree still forced to reason from an economical perspective, as they need to comply with yearly budgets.

Helen Ferm harmonized with how eHealth and health care in general always should be beneficial for the patient. Values associated to the well-being of the patients should be prioritized and the basic idea is not that hospitals should focus on making a profit. It further became declared how she believed there often existed large gaps between the end-user, habitually the patients, and the politicians who often are the ones determining which values that are primarily chosen and considered.

“The persons defining the requirements is rarely a nurse or a doctor, but rather an IT person, which often causes complications for the actual end-users”
- Helen Ferm

Lastly, Ingrid Fröberg expressed how a doctor, yet again, always should have the patient's well-being prioritized but how it in the back of one’s mind, always also should exist an economic perspective in order to make sure that given resources are strategically distributed. This could today occasionally be hard as the persons working on a business level and the ones working “on the floor” in the health care are talking completely different languages. It should furthermore be noted that this was a common judgment from several interviewees.

The overwhelming judgment that non-value drivers are of utmost importance as they directly reflect the end-users, being the patients, suggests that this hypothesis can be validated as true.

H12: The opinions of patients and citizens should have equal impact as any other stakeholder when developing the future health care

The last hypothesis conversed the dilemma, reflected as a contender of being the root-cause for what a set of the interviewees referred to as a tripartite problem in the health care, which basically summarized means the production, the payer and the client. Yet again, a majority believed how the patients and citizens unquestionably should have a large impact in the evolvement of the future health care as the care itself is targeting them as customers. However, as the tripartite problem portrays, it is not the clients, insinuating the patients that actually pays for the health care, but the county councils, and this sometimes presents conflicts. The patients are nonetheless considered being the extended arm of the county council, where the county council quite often utilizes so-called “brukarvård”. This implies how the county council sometimes brings in patient-associations with selected patients and discusses certain areas in the health care in order to achieve a better understanding of the reality and what is seen needing change according to the patients. It was further realized, as with several other areas, how it existed unalike approaches of thinking when comparing the public health care with the private health care. The patients of the private health care are often presented with the opportunity of choosing their own care provider, which basically means that private actors are more dependent on listening to their patients’ needs and wishes compared to the patients of the public health care.

"One must try to influence individuals in the health care working “on the floor” to be more involved in terms of decision-making"
- Eric Wahlberg

Helen Ferm emphasized how the health care should make better and more use of reference groups that directly consists of solely those who represent the patients and the actual users of the EHR-systems, as she also believed that the citizens and patients have too little
Ingrid Fröberg concurred that opinions of the patients should not be ignored but also wanted to alert that it easily could get out of hand if patients would get too much influence, as one could ask for e.g. a thorough whole-body examination at the every slightest concern, which would drain to much resources that could be more efficiently be used elsewhere. She therefore argued how it should exist a professional instance, inspecting whether an examination request always would be appropriate. It was also understood that the patient’s choice of surgery location could greatly be improved, as their options today are sometimes very limited.

"The actual end-user must be involved to a greater extent compared to what they do today when specifications are being developed"
- Helen Ferm

Aron Sobin further wanted to shed light on how the believes that the patients firstly will have to both own and have access to their medical records before they can be involved to a wider extent, whereas Eric Wahlberg additionally argued how one should focus on targeting the dilemma where the majority of the exploiting health care segment today are the elderly ones, who seldom neither have the keenness or stamina to be active in eHealth debates.

"The day the patients have full access to their own medical records will result in them also having a greater impact in the health care"
- Aron Sobin

As with the previous hypothesis, see H11, the overall attitude of the interviewees inclined how the opinions of the citizens and patients undeniably should have a high impact, but whereas the tripartite problem and risk of utilizing resources to excess as well as patients not owning their own journals on the contrary could be a explanation to why their impact is yet not as high as other stakeholders’. The verdict is thus that the opinions of patients and citizens should have a high impact, but not presently comparable to other stakeholders, which make the hypothesis false.

5.4.1 Conclusive summary of the section
The final concept of the theoretical framework has primarily discussed what values that should be considered and who one should involve and listen to when business modeling with a focus on patient involvement. It emerged that values not directly associated to incomes and monetary gains should not be ignored but the dilemma seems to lie in whether how much impact these non-financial values actually have in practice. Streamlining the health care systems to save time and continuously increase and maintain the quality in the health care where considered as more important value-drivers than those directed with the purpose of purely making money. However, strict yearly budgets that in the end force medical directors to excessively reason from an economical perspective, seems to be a reason for why financial values still are predominantly prioritized. It was further concluded that the well-being of the patient always should be considered as the most important, but how large gaps between those who develop specifications and the actual end-users sometimes causes conflicts. Ultimately, it should be noted that a certain economical perspective was agreed that it would have to exist in order to make sure that given resources are strategically distributed within the health care. After having reviewed the impact patients and citizens actually seemed to have in terms of business modeling, it could be established that a tripartite problem seemed to be the underling dilemma, as it is not actually the patients but the county council that pays for the health care. It was further revealed how it yet again existed unalike approaches of thinking when comparing the public health care with the private, where the private health care is more dependent on listening to their patients’ needs and wishes. Other aspects that were debated
were the increased use of reference groups and professional instances, as well as the subsequent consequences of whether patients where to own their own medical records.

Consequently, the two most prominent identified aspects often mentioned to “eHealth in relation to business modeling” are judged to be (1) Non-financial value drivers are equally imperative and (2) Distinctive stakeholder network – crucial not ignoring the patient as a stakeholder, see Table 10. The two aspects will be further discussed in “Chapter 6 - Discussion”.

### eHealth in relation to business modeling

<table>
<thead>
<tr>
<th>Non-financial value drivers are considered equally imperative</th>
<th>Importance of individual value identification</th>
<th>Activates within health care organizations</th>
<th>Socio-economical outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinctive stakeholder network – crucial not ignoring the patient as a stakeholder</td>
<td>Implementing a business-like philosophy in the field of health care</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10 - The most prominent aspects seen influencing eHealth services from a business modeling perspective

After having gone through all of the theoretical concepts and each hypothesis, table 11 beneath is conclusively presenting all of the identified prominent aspects.

<table>
<thead>
<tr>
<th>eHealth in relation to interoperability</th>
<th>eHealth in relation to security</th>
<th>eHealth in relation to mobility</th>
<th>eHealth in relation to business modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship between technology and human interaction</td>
<td>Patient awareness of underlying security</td>
<td>Mobility is strongly affected by interoperability- and security aspects</td>
<td>Non-financial value drivers are considered equally imperative</td>
</tr>
<tr>
<td>Simplifies access to longitudinal medical records</td>
<td>eHealth - bringing new risks to patient integrity</td>
<td>Correlations between security aspects and current vs. future use of mobile devices</td>
<td>Distinctive stakeholder network – crucial not ignoring the patient as a stakeholder</td>
</tr>
<tr>
<td>Administration and documentation issues</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11 - Concluding table of the prominent aspects for every theoretical concept
5.5 Case study analysis – Business Model Canvas

The two candidates of the case studies was Skärholmens ÖNH Centrum and Karolinska Universitetssjukhuset. Skärholmens ÖNH Centrum is a private health care practice who specializes on treating ear-, nose- and throat diseases, as well as final treatment both medically and surgically. Skärholmens ÖNH Centrum have recently switched EHR-system from Profdoc PMO to TakeCare and was chosen as a candidate due to being a smaller and private health care facility. The other case study involved Karolinska Universitetssjukhuset, one of the largest public university hospitals in Sweden. Karolinska Universitetssjukhuset also transitioned into utilizing the TakeCare EHR-system from previously having used Siemens Melior.

The following pages will present a finalized BMC of the transition of EHR-system for each case study where the black comments signify what either Skärholmens ÖNH Centrum or Karolinska Universitetssjukhuset previously represented before switching EHR-system. The green comments however represent changes brought upon the introduction of the EHR-system TakeCare. The changes have then been analyzed and translated into internal and external benefits, which are presented under the following impact analysis for each case study (see chapter 5.5.1 and 5.5.2). All of the observations originate from interviews with a representative of each health care facility.

Another purpose of the case studies apart from utilizing the BMC technique and plot the changes related to their respective business model and its subsequent benefits, was trying to identify interrelations between the findings found here with the most prominent aspects established from chapter 5, which will constitute what will be a partial answer to RQ2 (see chapter 1.4). The authors also found it interesting and important trying to unearth relations between a solely theoretical framework with the practical reality of what a major implementation of an eHealth service, in this case an EHR-system transition, resulted in and therefore with this thesis, try to provide a deeper academic contribution.
5.5.1 A study of Skärholmens ÖNH Centrum

Figure 5 beneath presents changes brought upon the introduction of the EHR-system TakeCare at Skärholmens ÖNH Centrum. Further explanation of the BMC technique can be found at chapter 3.6. Relations between the identified benefits from the impact analysis with previously stated prominent aspects will be brought up in the following discussion chapter.

<table>
<thead>
<tr>
<th>Equipment and use</th>
<th>Personal costs</th>
<th>Lower IT costs due to relieved lower direct costs because of digitalized journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>No longer need to buy licenses for the EHR system</td>
<td>Decrease maintenance and update costs</td>
<td>Reduced printing costs due to digitalized journals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partnership with pharmacies</th>
<th>Connection to pharmacies</th>
<th>Handle everything themselves</th>
<th>Buy the service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Knowledge</td>
<td>Personal Knowledge</td>
<td>Personal Knowledge</td>
<td>Personal Knowledge</td>
</tr>
<tr>
<td>Fixed capital &amp; equipment</td>
<td>Fixed capital &amp; equipment</td>
<td>Fixed capital &amp; equipment</td>
<td>Fixed capital &amp; equipment</td>
</tr>
<tr>
<td>Digitalization of journals</td>
<td>Digitalization of journals</td>
<td>Digitalization of journals</td>
<td>Digitalization of journals</td>
</tr>
<tr>
<td>No own servers</td>
<td>No own servers</td>
<td>No own servers</td>
<td>No own servers</td>
</tr>
<tr>
<td>Back-up and update costs</td>
<td>Back-up and update costs</td>
<td>Back-up and update costs</td>
<td>Back-up and update costs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources</th>
<th>Value Proposition</th>
<th>Activities</th>
<th>BMC framework of an EHR-system transition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Text in green indicates changes brought upon the introduction of the EHR-system TakeCare</td>
</tr>
</tbody>
</table>

Figure 5 – BMC framework of an EHR-system transition. Text in green indicates changes brought upon the introduction of the EHR-system TakeCare
Impact analysis
This section highlights the internal and external benefits related to the implementation and transition from the EHR-system Profdoc PMO to TakeCare. The implementation of the TakeCare EHR-system at Skärholmens ÖNH centrum has led to a number of significant internal- and external benefits listed with an explanation below:

Internal benefits
• **Digitalized medical records**
  Skärholmens previous EHR-system, namely PMO by Profdoc, was largely still dependent on medical records and other supplies in paper form, which now has practically been removed due to TakeCare being totally digitalized. Skärholmens ÖNH centrum has therefore benefitted from lowered inventory costs related to tasks such as printing and tray storage, which both was time- and effort consuming and added no real customer value.

• **Central server management**
  Another major internal benefit affects the IT-management, as it along the transition to TakeCare has been practically reduced to a minimum, as the previous EHR-system was functioning locally with servers and associated equipment handling the whole facility. Maintenance costs, updating of the software and hardware as well as hiring staff have now been greatly reduced as TakeCare is functioning from a central server. Skärholmens ÖNH centrum has also gone from having purchased licenses for the PMO-application to instead paying per user, which is seen beneficial due to being less expensive.

• **Access to longitudinal patient history with generally increased efficiency**
  Due to TakeCare being customizable in terms of modules, Skärholmens ÖNH centrum has benefitted from integrated modules handling invoices, ePrescriptions, financial tasks on the facility and an incorporated module that is used to directly handle the economical translation and payment per action from the County Council for each patient. The TakeCare system also facilitates access to longitudinal patient history, which increases the transparency and supports the doctors awareness as well as patients visiting experience as the patient does not need to explain his or her previous medical history, which subsequently avoids duplication test to be conducted. All of these modules have greatly improved the internal and operational processes as well as the communication within the facility.

External benefits
• **Visibility**
  As TakeCare is the leading EHR-system in the county of Stockholm as of 2013, see Appendix E, Skärholmens ÖNH centrum has benefitted from becoming more visible for the County Councils as well as other health care centers, which subsequently have made them more observable as a fitting health care facility for certain types of referral patients. It also fosters the access to longitudinal patient history as previous visits and diagnoses are stored among all health facilities utilizing the TakeCare system.

• **ePrescriptions and pharmacy connections**
  TakeCare has with its integrated module for writing ePrescriptions made it possible for the doctors to offer the patients the possibility of no longer having to collect a recipe for medication in paper-form, but can now more easily go to their local pharmacy.

• **Secure and ready for future development**
  TakeCare being an up-to-date EHR-system allowing Skärholmens ÖNH centrum to be ready for future changes as the system is already implemented. The health care professionals’ using the system also trust it being more safe and secure.
5.5.2 A study of Karolinska Universitetssjukhuset

Figure 6 Beneath present changes brought upon the introduction of the EHR system TakeCare at Karolinska Universitetssjukhuset. Further explanation of the BMC technique can be found in chapter 3.6. Relations between the identified benefits from the impact analysis with previously stated prominent aspects will be brought up in the following discussion.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Challenges</th>
<th>Key Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed capital and equipment</td>
<td>Decreased maintenance costs</td>
<td>Decreased turnover and updated costs</td>
</tr>
<tr>
<td>Personnel expenses</td>
<td>Reduced back-end and update costs</td>
<td>Reduced per action from the county council</td>
</tr>
<tr>
<td>Rent premises</td>
<td>Local servers</td>
<td>County council</td>
</tr>
</tbody>
</table>

**Figure 6 - BMC framework of an EHR system transition.** Text in green indicates changes brought upon by the introduction of the EHR system TakeCare.
Impact analysis
This section highlights the *internal* and *external benefits* related to the implementation and transition from the EHR-system Siemens Melior to TakeCare. The implementation of the TakeCare EHR-system at Karolinska Universitetssjukhuset centrum has led to a number of significant internal- and external benefits listed with an explanation below:

Internal benefits

- **Integrated modules**
  The TakeCare EHR-system with its user-interface of different customizable modules has resulted in a set of internal benefits that greatly improves both *internal processes* and *communication aspects*. Firstly, the waiting times of test- and diagnosis results have been lowered as doctors no longer in the same extent have to call and ask for them, which have saved both time and money. Secondly, there has been an improved security standard on the pharmaceutical side, both in terms of automatic alerts in cases of medication error and the process of medicine prescription. Lastly, TakeCare has aided the personnel at Karolinska Universitetssjukhuset, as they now much more seldom need to go to the radiology to collect pictures as it is now automatically handled within the system, which saves time, effort and resources.

- **NOD-connection**
  Patients are now directly connected to NOD, which automatically adds stored information from the national registration to visiting patients lowering mistakes and minimizes non-value adding time it else would have required.

- **Central client system**
  TakeCare is a fully central server/client system compared to the previous local one, resulting in no longer having the same IT-maintenance cost and updates and storages is handled automatically, which is claimed being cost-saving.

External benefits

- **Longitudinal patient history**
  Due to Karolinska Universitetssjukhuset having transitioned to TakeCare and now can view previous visits and the whole medical history of the patients directly connected to health care facilities using the same EHR-system, the health care professionals at Karolinska Universitetssjukhuset no longer need to conduct diagnostics that may already have been carried out. This both save time and money and the patient can trust and assured that all relevant information will be up-to-date during visits

- **ePrescriptions and pharmacy connections**
  TakeCare has with its integrated module for writing ePrescriptions made it possible for the doctors to offer the patients the possibility of no longer having to collect a recipe for medication in paper-form, but can now more easily go to their local pharmacy

- **Secure and ready for future development**
  TakeCare is an up-to-date EHR-system allowing Karolinska Universitetssjukhuset to be ready for future changes more effectively as the system is already implemented. The health care professionals’ using the system also trusts it and feels it being more robust and secure than before
5.5.3 Correlations between impact analyses and prominent aspects

This section will discuss identified correlations between the previously stated prominent aspects with the benefits acknowledged from having implemented an eHealth service, which have been explained in the impact analysis for each previous health care organization.

Skärholmens ÖNH Centrum

As for Skärholmens ÖNH Centrum, the authors consider there being several correlations between the benefits associated to the implementation of TakeCare from PMO and the previous prominent aspects. The most apparent are listed and explained below with the first term/terms referring to an identified benefit from the related impact analysis and the second term/terms a prominent aspect(s) originating from table 11.

- **Access to longitudinal patient history with generally increased efficiency and Visibility** could be related to:
  - *Simplifies access to longitudinal medical records*
  - *Mobility is strongly affected by interoperability- and security aspects*

It became evident how the implementation of TakeCare has cultivated Skärholmens ÖNH Centrums ability to take part of and share data between other health care facilities and hospitals connected to the TakeCare infrastructure, which was not possible to the same extent before due to the different EHR-systems not being cooperative. This can be related to the first aspect, *Simplifies access to longitudinal medical records*, which argues how increased interoperability is seen leading to simplified access of patient history, which apparently did occur in the case of Skärholmens ÖNH Centrum.

The daily performed work processes at Skärholmens ÖNH Centrum has also benefitted from a generally increased efficiency and mobility after having switched over to TakeCare, as most functions now are directly available as customizable modules in the system. This involves functions that directly are able to manage e.g. invoices and thus eliminate paper handling and storage. The additional ability to login everywhere due to TakeCare being controlled from a central server with a unanimous client, offers a heightened interoperability between different modules, which also strengthens the aspect that claims how increased interoperability also leads to increased mobility.

- **ePrescriptions and pharmacy connections** could be related to:
  - *Mobility is strongly affected by interoperability and security aspects*

The doctors at Skärholmens ÖNH Centrum can with the added connection to ePrescriptions and pharmacies with TakeCare, now directly view where medication is being available at all the pharmacies and no longer have to manually write prescriptions in paper form. This entails how the patients, with an ID card easily can retrieve their medication at any pharmacy of their choosing, which unquestionably can be related to mobility. It can therefore be argued how the increased interoperability due to the benefitting linkage between pharmacies and Skärholmens ÖNH Centrum as well as the ability to write ePrescriptions can be related to the aspect referred to as *Mobility is strongly affected by interoperability- and security aspects*. 
Karolinska Universitetssjukhuset
As for Karolinska Universitetssjukhuset, the authors consider that there are several relations between the benefits associated to the implementation of TakeCare from Melior and the previously identified prominent aspects. The most apparent are listed and explained below with the first term/terms referring to a benefit from the related impact analysis and the second term/terms a prominent aspect(s) originating from table 11.

- **Longitudinal patient history** and **integrated modules** could be related to:
  - *Simplifies access to longitudinal medical records*
  - *Mobility is strongly affected by interoperability- and security aspects*

Similar to the case of Skärholmens ÖNH Centrum, most hospitals and health care centers that are connected the same TakeCare EHR-system can now therefore converse and exchange data with each other. This both fosters the possibility to access longitudinal patient history and develops the mobility in the health care. Every documented patient-visit can now after being approved by the patient, be viewed by another doctor at a different hospital that is linked to TakeCare system. Karolinska Universitetssjukhuset can now also much faster and in some aspects even for the first time with the integrated modules, assess previous patient history, view earlier diagnoses and medication, which e.g. will lead to the avoidance of unnecessary duplication tests of a patient. This will undoubtedly increase the awareness among the doctors, which in the long term could lead to a reduction of medical errors that saves both time and money.
6 Discussion

This chapter aims to discuss the most prominent aspects frequently mentioned and seen to pose challenges for the continued development of eHealth services. These aspects were highlighted in the previous chapter under each concept of the theoretical framework as being of most relevance to the objective of this thesis. The chapter will also encompass an ethical- and sustainability discussion towards the end. Hence, this chapter will, in combination with the previously presented analysis, additionally elucidate the answers to the research questions, introduced in section 1.4.

From the analysis chapter, nine aspects were highlighted and evaluated being most prominent in relation to the development of eHealth services in Sweden, which will now be further discussed. Each prominent aspect will be used as a header and further discussed below.

Prominent aspects related to interoperability

Regarding the aspects termed Relationship between technology and human interaction, it was often recalling how the development of EHR-systems seems to be put on the IT-department within larger organizations, where logically a set of assigned programmers are chosen to improve the systems without no or little interaction with the actual end-users and the profession the systems are to be used in. Another aspect that not should be ignored as a reason for why the social interoperability could be lacking, could have to do with TakeCare being the leading EHR-system in Stockholm. The company most certainly knows that their system is at the forefront compared to their competitors and therefore does not excessively have to market themselves to other health care facilitates as these health care centers most likely are showing interest to join on their own motion. This probably contributes to why the user-interface of the system is not the top priority, as TakeCare instead could choose to focus on the development of modules and expansion of technical functionalities. As TakeCare rapidly has expanded the past few years, it would be very difficult to satisfy all of its unique users with different needs. Lastly, the deficiency of social interoperability is probably also an outcome of EHR-systems in general often being built up from previous versions and seldom from the ground up.

In terms of the aspect Simplifies access to longitudinal medical records, it became evident from partly the interviews but also the impact analysis, how connected TakeCare health care professionals much more easily and directly now can view previous medical records of their patients, which was not possible with previous EHR-systems. This added feature relieves patients of having to be updated and tell his or her doctor e.g. what medication they are using when visiting a new health care facility and compiles with how it becomes more enabling for the patients, which is previously discussed by Eysenbach (see chapter 3.1.1). Doctors can further most likely offer a more efficient consultation for the patient if they have received authorization to read the patient’s record, as well as lowering performing diagnostic test in vain if the patient has forgotten if he or she already has done the test before. It would also minimize the use of “just-in-case-medication” if the doctor were lacking enough medical patient history during e.g. waiting for test results.

The aspects referred to Administration and documentation issues were also judge to be essential for the future health care as each and every interviewee with several years of experience from the health care argued how it has gotten out of hand. The requirement of e.g. having to ask a minor child if he or she is smoking or plays sports was even regarded as absurd in some cases. At the same time doctors and nurses have very limited influence or power to protest, as they have to comply with new directives of documentation requirements. Interestingly, it was further understood that doctors were rarely given an explanation of what these added documentation requirements would be used for, as the National Board of Health and Welfare seldom clarifies its intention, which perhaps would be more suitable in order to
avoid a riot or recover the negative attitude more and more doctors seem to hold against the documentation.

**Prominent aspects related to security**

Switching perspective to *Patient awareness of underlying security*, the authors further want to bring up additional aspects not illuminated during the analysis chapter. It goes without saying that preferably, if one could choose, you never want to go the hospital, but stay healthy. But if you nevertheless have to, a patient most likely focus on what he or she will have to go through during a visit in order to become healthy again, not the underlying security of medical records or the EHR-system. This probably goes hand in hand with how patients most certainly generally associate the health care and its personnel of being naturally ethical and correct, and errors and the misusage of private medical information being nonexistent, which most likely has contributed to why the trust is naturally so high for the current health care in Sweden. This will most likely also not change if no drastic event occurs to the patients. However, it will although probably be different the day the patients own their own medical record and concur that the health care receives authorization to read it and not other way around. This would also most likely generally be enhanced if the health care becomes more *encouraging* as Eysenbach promotes, see chapter 3.1.1. As why *eHealth – bringing new risks to patient integrity* was chosen as a prominent aspect, it is noteworthy to elucidate how several of the interviewees saw a concern in the importance of how a patient always should obtain a professional explanation for a diagnosis or test results if the patient in the future is to be able to own and read his or her own medical record. The risk of the patient misinterpreting non-complete or sloppy written information in combination with perhaps being a hypochondriac could easily lead to unnecessary suspicions and subsequently followed by mental breakdowns, fears for why the personal contact with the doctors not should be entirely withdrawn.

**Prominent aspects related to mobility**

The two chosen prominent aspects related to the mobility perspective, being *Mobility is strongly affected by interoperability- and security aspects* and *Correlations between security aspects and current vs. future use of mobile devices* will here be discussed together and hopefully bring additional interesting arguments. If one initially studies the identified correlation between how increased interoperability also consequently fosters increased mobility, in an ideal world of health care systems, all EHR-systems would firstly have been able to communicate with each other. This would have provided a citizen with the choice of going to any geographical location in Sweden, but also eventually abroad and be able to receive health care that is directly connected to a shared medical record database similar to the intention of NPÖ, see *chapter 3.2.2. However, a possible explanation for why the interoperability is and has been improved so slowly in the Swedish health care according to the authors of this thesis is believed to be due to the health being considered very bureaucratic and thus hard to change. Different EHR-systems and gigantic archives have progressively been built up during many years alongside huge costs, and no county council would most likely want to succumb to another system “without a fight”. The whole dilemma would perhaps best be solved from a national or even European level, where it could be decided that it only should exist one EHR-system among all health care facilities or one would have to introduce improved cooperation between the existing systems with detailed requirements on what information that should be sent and received. Further related to the mobility aspects being hindered by security and how an increased usage of mobile devices was established as a sought after desire, one could draw a parallel to Apple and their world-known iPhones and iPads. They are, among other things, known to be reluctant to offer third-party companies the ability to have complete access and control over their operative system, which some interviewees argued perhaps being necessary in order to use Apples products as a secure
platform receptive of personal medical information. It might yet again possibly require a legislative change before we will be able to use our mobile devices as recipients of medical records to a greater extent.

**Prominent aspects related to business modeling**

Last but not least, it was universally argued among the interviewees how the opinions of the patients and citizens without doubt must be included when business modeling the future of the Swedish health care. It also became evident how value drivers not directly associated to profit and savings should also be taken into account, but it is genuinely hard to realize it. This brings us to the last two chosen prominent aspects, namely, *Non-financial value drivers are considered equally imperative and Distinctive stakeholder network – crucial not ignoring the patient as a stakeholder.* Regarding how the health care in fact is targeting the well-being of the patients being the customers, one can wonder why the patients do not have as much influence as they perhaps should have. This will most likely change when medical records are actually owned by the patient and the patient is providing healthcare the authorization to read it and not vice versa, which partly is the case in the United States. Furthermore, the acclaimed large gaps between the active stakeholders setting up specifications and the end-users, could be why a value expressed from a doctor or patient as valuable, is easily lost or misinterpreted along the road and also might be difficult to explain as economically feasible. It was also distinguished how the staff who works on higher level within the hierarchy of a business sometimes reasons how doctors seldom have any requisite knowledge of how money and the health care go together, as it is completely foreign grounds for them. Economical questions also seem to have a tendency of being ordered “from above” and persons on lower levels in the hierarchy simply have adapted, which sometimes presents negative consequences.

**Ethics and sustainability of the thesis**

During the entire research process of this master thesis, the authors followed a set of ethical guidelines to ensure that both the authors of study as well as all of the individuals involved felt secure and content, which is argued as an advantage during a longer project (Collis and Hussey, 2009). The ethical guidelines that are considered being followed and fulfilled where namely:

- The participants were all thoroughly informed of the aim and background of why the authors conducted this thesis at every interview
- All of the involved individuals mentioned in the research voluntarily chose whether they wanted to participate, which hopefully resulted in an increased trustworthiness of the answers they presented in each interview
- Confidentiality and anonymity were always consulted with each and every interviewee and they were asked one more time if they could be quoted and mentioned by name and profession to make sure that the quotes were truthfully and correctly stated
- The dignity of the participants was also constantly aimed to be reserved. All of the empirics was delimited to be conducted in Sweden, in order to minimize the risk of cultural clashes
- All the participants where always immediately asked if they agreed on being recorded during the interviews
- The authors did also several times re-check the collected statements and quotes before
initiating the analysis phase, in order to make sure that nothing had been misinterpreted during the empirical gathering with the purpose of increasing the overall ethical- and credibility level of the content

Regarding applying a sustainability perspective in the healthcare, primarily directed at a people and social level, it can quickly be established how it is highly challenging as the healthcare incorporates a wide set of services, activities and procedures. The authors believe, in order for the healthcare to nurture a sustainability approach, how there should exist a designated advocate or executive champion, who insistently promotes sustainability aspects to other important investors. This person should advocate for sustainability within e.g. a hospital organization, by linking activities associated to sustainability values to the overall strategies of the hospital and these values should conceivably also be reflected in the overall mission and/or vision of the hospital. This would also be benefitting when defining wide-ranging norms as well as business modeling for the near future. It is also important that one conducts some sort of performance measurement system with suitable KPIs such as the number of sick-leaves per year or annual personnel turnover. It is also of utmost importance as hypothesis eleven and twelve of the thesis did emphasize, that non-financial values expressed by both citizens and health care professionals are being considered apart from only focus on economical results, as they genuinely reflect the social side of sustainability. It should further be noted that incorporating the so-called Triple-Bottom-Line approach, meaning how a business integrates sustainability into business-modeling without making it official or telling anybody, is bound to fail in the long-run. Ultimately, the authors believe that it does not exist any correct or “right way” for an organization to become sustainable, which also is applicable for the health care.
7 Conclusion

This chapter will fulfill the objective of this thesis on investigating and interpreting the most prominent aspects and benefits on the development of eHealth in Sweden, by drawing conclusions on the two research questions posed in chapter 1.4.

The summarized objective of this master thesis was to: “Investigate and interpret the most prominent aspects associated to eHealth services in Sweden, as well as subsequent benefits where an implementation of an eHealth service have taken place”. In order to pursue an answer to the objective, two research questions were formulated, being:

- **RQ1:** Which key aspects are from an interoperability, mobility, security and business-modeling viewpoint seen as prominent in relation to eHealth services from a multi-user perspective?

- **RQ2:** What internal and external benefits can be identified after having implemented an eHealth service and can these in turn be correlated to the prominent aspects found in RQ1?

Concerning RQ1, the theoretical framework, see chapter 4, with the presented hypotheses and the following analysis chapter, see chapter 5, revealed a set of prominent aspects adhering to opinions having impact on both the patients and citizens as well as health care professionals. They were acknowledged as:

In relation to the interoperability perspective, it was initially established that it is important that both a technical as well as social interoperability exist and converse with each other in the health care and especially in relation to EHR-systems. It was furthermore revealed how EHR-systems today generally are considered having a steep learning curve, not being intuitive and lack a user-friendly interface. However, increased interoperability is although seen to entail simplified access to longitudinal medical records, where the implementation of the EHR-system TakeCare has made it possible for interconnected health centers and hospitals to exchange information such as medical records, previous diagnostics and medications with each other. It also became evident how time spent with administration and documentation tasks do not become more time-consuming if the interoperability increases in the health care, but is affected by new requirements and regulations from the Swedish National Board of Health and Welfare. Increased interoperability in EHR-systems have on the contrary instead been identified to speed up the documentation process, which unanimously was considered taking up too much time, and could instead be spent with the patient.

Continuing with identified prominent aspects related to security, it was initially established how patients and citizens have none or very low awareness of the underlying security in today’s health care. It was generally discovered how health care professionals simply believed patients blindly trust the health care being secured and safeguarded, whereas medical consultation being of higher priority for the patient during doctor appointment, also was an argument for why the awareness might be so low. However, it emerged that the awareness of the patients probably will change in the future if patients were to obtain greater opportunities to be active in their own health care, especially the day when patients will own and have access to their own medical records. The whole eHealth movement is also argued posing new security risks mostly because of the increased involvement and influence of mobile devices, why the shell- and universal security package beyond a secure identification most likely has to be reviewed. It was further noted that additional security threats was considered to arise when the patients attain increased access to their medical records.
Regarding eHealth in relation to mobility aspects, an apparent relationship was established between interoperability and mobility in the health care, where integrated modules in EHR-systems offering e.g. the functionally of directly being connected to ePrescriptions and pharmacies were a good illustration. However, security aspects are pondered hindering the development of how mobile the health care can become, where yet again the general involvement of mobile devices is argued not being sufficiently secured.

Moreover, non-financial values should unquestionably not be ignored when business-modeling the future health care, but the dilemma appeared to be more referred to whether how much impact non-financial values actually have in practice. Strict annual budgets and spacious gaps between the individuals who commonly have large impact when business modeling and those who work "on the floor" in health care, the end-users, was argued being possible explanations. It was also revealed how it existed a different approach between private- and public health care, where actors associated to the private healthcare has to be more attentive to the opinions of the patients. Finally, it also became evident that one should not ignore the opinions of patients and citizens as stakeholders, but a tripartite-dilemma as well as limited access of ones medical records are considered arguments of why their impact and influence does not yet have the same weight as other investors.

Regarding RQ2, it became evident how a set of internal and external benefits could be identified from the two case studies that both underwent a switch of EHR-system. It was further established how there seemed to be relations between some of the prominent aspects and the identified benefits, all of which are listed below.

**Skärholmens ÖNH Centrum**
- Relieved of medical records in paper-form and thus subsequently lowered inventory costs besides saved time and effort due to digitalized medical records
- General IT-management and maintenance costs have been reduced due to TakeCare utilizing a central server management and is also financed per user instead of licenses
- Increased transparency as well as heightened awareness of patient due to better access to longitudinal patient history. Generally increased efficiency has also been acknowledged due to TakeCare having different integrated and customizable modules such as being connected to pharmacies and directly able to write ePrescriptions. TakeCare being one of the major EHR-systems at the moment also entails an improved visibility among other health care centers and hospitals. These benefits are seen to have a relation to the prominent aspects referred to as Mobility is strongly affected by interoperability- and security aspects and Simplifies access to longitudinal medical records, which both are further explained in the discussion chapter (Chapter 6)

**Karolinska Universitetssjukhuset**
- Improved internal processes and communication due to integrated modules such as ePrescriptions as well as an increased access to longitudinal patient history, being interconnected and more visible to other health centers utilizing the TakeCare system, which also entails easier referral of patients to other health care centers. These benefits are seen to have a relation to the prominent aspects referred to as Mobility is strongly affected by interoperability- and security aspects and Simplifies access to longitudinal medical records, which both are further explained in the discussion chapter (Chapter 6)
- Lowered IT-maintenance and costs due to central client system
8 Further research

This chapter will propose some future research areas, which have been identified during the study as appropriate to further look into, but were omitted due to the scope of the thesis as well as the time limit.

As it now surely has emerged due to the subject of eHealth being very broad, there are an abundant number of interesting topics that can be further investigated. As the whole eHealth movement is currently evolving at this very instance, one can but simply predict what the future health care will look like. The authors of this thesis have however identified a set of areas considered being relevant to look into.

Firstly, the subject of eHealth and its implementation in Sweden have mostly been studied comprehensively in relation to the health care, while there seems to be a gap of academic research if instead redirecting the scope towards the social care and the National Board of Health and Welfare. Comparative studies pursuing holistic discoveries is supposedly therefore of dire need and interest alongside previously unilateral conducted research. It would also be relevant to compare how the findings in this study can be compared with other countries and their health care in order to find areas where Sweden is either considered at the forefront or in the need of improvement.

Secondly, this study is very comprehensive and covers a lot of different aspects and concepts, which is why one most likely would benefit from deeper investigating of a specific concept, e.g. the interoperability perspective. A similar approach would be interesting to apply for the Business Model Canvas template. Including more case studies would in themselves also be valuable, but going further and analyzing different strategies and best practices that could be applied after having conducted a impact analysis would be a interesting continuation. Another natural extension would be to construct a management plan, where the prominent aspects and benefiting outcomes identified in this study could be used as foundation.

Thirdly, a major focus has in this study been placed on EHR-systems as an eHealth service, but it would be interesting to also investigate other types of services related to eHealth such as e.g. functionalities targeting the elderly customer segment, which have been identified as a customer group of high importance when one generally reviews eHealth debates. It would also be interesting to investigate changes brought upon an EHR-system transition based on actual economical figures, as the hypotheses related to monetary gains now could be argued as somewhat vague.

Lastly, the interviewees that took part in this study were exclusively persons that worked or work in health care. Including a survey that targets actual patients and citizens would most likely bring other relevant contributions. It would also be interesting to compare how the identified aspects found from the interviews in the study correlates to ones gathered from patient and citizens, which also would further enhance the credibility of the thesis. The survey could also partly include quantitative data, whose results would be positively appreciated from a triangulation of data perspective.
9 References

9.1 Scientific articles


Salvi, Dario, Elena Villalba Mora, and Maria Teresa Arredondo Waldmeyer. "An architecture for secure e-Health systems", Universidad Politecnica de Madrid, Spain, (2010), Vol:1, pp. 2 - 4


9.2 Books and general articles


eHälsa – “I landstingena” (Augusti 2013), SLIT-gruppen, Lars Jerlvall and Thomas Pehrsson, Year: 2013, pp. 2-67


68
Patricia, G. A. Noam et al, “Coming to terms: Scoping Interoperability for Health Care”, Health Level Seven, EHR Interoperability Work Group, Feb 7, 2007, pp. 4-31


9.3 Websites


Figure 7 - Business Model Canvas Template
## Appendix B – Interview persons

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Johnny Sobin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company/organization name</strong></td>
<td>Skärholmens ÖNH Centrum</td>
</tr>
<tr>
<td><strong>Roll and title</strong></td>
<td>ENT Specialist, Medical Director Praktikertjänst AB manager</td>
</tr>
<tr>
<td><strong>Date of interview</strong></td>
<td>2014-03-14</td>
</tr>
<tr>
<td><strong>Company description</strong></td>
<td>Skärholmens ÖNH Centrum treats ear-, nose- and throat diseases, as well as final treatment both medically and surgically.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Aron Sobin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company/organization name</strong></td>
<td>Skärholmens ÖNH-centrum</td>
</tr>
</tbody>
</table>
| **Roll and title** | Previous KS experiences:  
- Head of Department  
- Division manager  
- Medical Director  
Currently: ENT Specialist, Medical Director Praktikertjänst AB |
| **Date of interview** | 2014-04-04 |
| **Company description** | Karolinska Universitetssjukhuset both has highly specialized as well as basic healthcare, world-known research and education. One of the largest hospitals in Sweden. Skärholmens ÖNH Centrum treats ear-, nose- and throat diseases, as well as final treatment both medically and surgically. |

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Helen Ferm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company/organization name</strong></td>
<td>Cybercom Group AB</td>
</tr>
<tr>
<td><strong>Roll and title</strong></td>
<td>Cybercom – Software developer consultant at Cybercom Group, Software engineer, former nurse, Regional Council of Jämtland – eHealth coordinator</td>
</tr>
<tr>
<td><strong>Date of interview</strong></td>
<td>2014-04-01</td>
</tr>
<tr>
<td><strong>Company description</strong></td>
<td>Cybercom Group AB is an IT consulting firm that helps leading corporations and organizations to take advantage of opportunities of the connected world. The company's areas of expertise cover the entire ecosystem of communications services.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Kerstin Arvedson</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company/organization name</strong></td>
<td>SITHS (Inera)</td>
</tr>
<tr>
<td><strong>Roll and title</strong></td>
<td>Chairman of SITHS management group and works within the policy &amp; authority group as well as assistant for registrational authority</td>
</tr>
<tr>
<td><strong>Date of interview</strong></td>
<td>2014-03-27</td>
</tr>
<tr>
<td><strong>Company description</strong></td>
<td>A national security solution for electronic identification and secure communication of information the national e-health</td>
</tr>
<tr>
<td>Interview person</td>
<td>SLL - HSA manager</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Company/organization name</td>
<td>HSA &amp; SLL</td>
</tr>
<tr>
<td>Roll and title</td>
<td>Stockholm’s County Council (SLL) with individual responsible for HSA.</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-03-14</td>
</tr>
<tr>
<td>Company description</td>
<td>An electronic catalog that includes quality secured information about individuals, functions and units within Sweden’s municipalities, counties and private providers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Sofie Zetterström</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company/organization name</td>
<td>Inera AB</td>
</tr>
<tr>
<td>Roll and title</td>
<td>Vice President and Marketing responsibility for Inera</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-03-28</td>
</tr>
<tr>
<td>Company description</td>
<td>Inera coordinates the county and regional joint eHealth and develop services for the benefit of residents, health and social care staff and decision makers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Eric Wahlberg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company/organization name</td>
<td>Praktikertjänst AB</td>
</tr>
<tr>
<td>Roll and title</td>
<td>Managing Director, Business Unit Health Care at Praktikertjänst AB</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-04-07</td>
</tr>
<tr>
<td>Company description</td>
<td>Praktikertjänst AB is the largest Swedish corporate group in the field of private health- and dental care</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Ingrid Fröberg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company/organization name</td>
<td>Edsbergs health center</td>
</tr>
<tr>
<td>Roll and title</td>
<td>Doctor, GP and Financial Manager Praktikertjänst AB - Manager</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-03-26</td>
</tr>
<tr>
<td>Company description</td>
<td>Edsbergs health center offers a health clinic, district-nurse clinic, child welfare and medical pedicure.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Annika Svedberg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company/organization name</td>
<td>Apoteket Hjärtat</td>
</tr>
<tr>
<td>Roll and title</td>
<td>Pharmacy and Quality Manager</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-04-01</td>
</tr>
<tr>
<td>Company description</td>
<td>Apoteket Hjärtat is Sweden's largest private pharmacy chain with more than 300 pharmacies and nearly 2,000 employees.</td>
</tr>
<tr>
<td>Interview person</td>
<td>Maria Kyhlbäck</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Company/organization</td>
<td>Akademiska Sjukhuset</td>
</tr>
<tr>
<td>name</td>
<td></td>
</tr>
<tr>
<td>Roll and title</td>
<td>Physiotherapist</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-03-14</td>
</tr>
<tr>
<td>Company description</td>
<td>– A university hospital in Uppsala</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Marianne Norelius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company/organization</td>
<td>Apoteket AB</td>
</tr>
<tr>
<td>name</td>
<td></td>
</tr>
<tr>
<td>Roll and title</td>
<td>Management Health Strategies</td>
</tr>
<tr>
<td>Date of interview</td>
<td>2014-04-02</td>
</tr>
<tr>
<td>Company description</td>
<td>Apoteket AB is the national pharmaceutical retailer. Apoteket AB is a government owned enterprise reporting to the Swedish Ministry of Health and Social Affairs.</td>
</tr>
</tbody>
</table>
12 Appendix C – Interview questions

Introduction – Explain who we are and the purpose of the master thesis

Initial questions:
- Ask if the interview could be recorded?
- Whether it is ok to quote you/the organization in the report?

General questions:
- Organization?
- Interview person?
- Date of interview?
- Role & Job tasks?
- Organization description?

Interoperability
How do you define interoperability?

I1: Both technical- and social interoperability is equally for the health care
- What do you consider the difference between technical/ social interoperability?
- Should there be a correlation between them and what in such cases?

I2: Increased interoperability is a prime driver for health care professionals to better perform diagnostics on their patients
- Do you see interoperability as something negative correlate with increase interoperability or is it only improving?
- How important is the role of interoperability in relation to the improvement of health care?
- If the level and the collaboration had worked even better, do you see yourself able to offer a better health care visit for the patients?
- Do you notice that there are any changes regarding the interoperability today?

I3: Increased interoperability has led to excessive time spent with administrative work and documentation for health care professionals instead of devoting the time interacting with the patient
- Do you document more today compared to before?
  - If yes, how come?
- Do you see any relation within increased documenting and increased interoperability?

I4: Increasing the interoperability in the health care directly results in monetary gains
- Do you see that improved interoperability result in to increased profits in the health care?
  - If yes, how come?
  - If no, why not?
- Do you believe this has any impact on a longer time-period?
Security
How do you define security and integrity?

S1: The evolving wave of eHealth services is alleged presenting new security risks, which could jeopardizes patient’s medical records

- Do you believe the general development of eHealth services will result in new security risks e.g. when handling patient information.
  - If yes or no, why?

S2: Patients, citizens and health care professionals are well aware about the underlying security of today’s EHR-systems and how health care records are being managed

- Do you believe that patient/citizens are aware of the underlying safety in today’s health care?
  - Do you have any experience yourself?
- Have you experience that the patients ask of about information regarding the underlying safety?
- Do the patient have enough knowledge how the safety within EHR-systems works?

S3: Internet connectivity is today functioning well and is not considered being an Achilles heel in terms of security among health care facilities

- Do you consider that Internet connection from a health care perspective is an Achilles heel?
- What other safety aspects except Internet connectivity that you evaluate as crucial?

Mobility
How do you define mobility?

M1: Interoperability- and security aspects are considered being what primarily limits how mobile health care can

Do you see that improved interoperability results into improved mobility/ accessibility?
Do you see that security aspects limit the mobility/ accessibility for the future health care?

- If yes, for who and how?
- If no, why? What is required instead for improved mobility?
- What do you think limited the mobility/accessibility in the future eHealth service?
- What level of impact do you predict that future eHealth services have on mobility/accessibility?
- Have you been limitary in the developing stage of a new service, due to the safety aspects wasn’t fulfilled?

M2: There is a sought after desire both by patients, citizens and health care professionals for an increased mobility associated to both received and provided health care

- Do you see any general demand from a patient- and citizen point of view after a increased mobility/accessibility?
  - If yes, why and after what?
  - How about yourself?
M3: An increased mobility and accessibility is required for reach out to the increasingly ageing population customer group

- How should the future health care approach to be able to reach out to the growing and aging population group we have seen in Sweden?
  - From a mobility perspective, are there any other ways to address the issue?
  - Do you see mobility as the most crucial area that has to be improved at the most?
- How could the potential segregation be avoided?
- Do you believe the ageing population has to use ICT-tools to keep up along with the development?

Business modeling:
What do you associate that business modeling within health care relates to?

B1: Non-financial value-drivers should have a comparable impact as purely financial value-drivers when making decisions within the health care

- What value driven aspects do you see as most prominent within business modeling in health care?
- Do you think that the overall aim is to make profit?
- Do you think that non-financial factors can be equally prioritized as purely financial factors if one prioritizes the health of the patients?

B2: The opinions of patients and citizens should have equal impact as any other stakeholder when developing the future health care

- Who has the most influence and decision-making power when major decisions are implemented in health care?
  - How is it today?
  - Are you satisfied how it is today?
- Do doctors and nurses have any influence in the decision-making?

General questions

- Are there any aspects or perspectives of significant impact regarding the development of eHealth in Sweden that we have not brought up?
- Is there anything that you want to add?
- What do you think of the future Swedish health care?
- Are there any other persons you would recommend us talking to?
BMC

- What changes do you see that the journal system X has resulted in?
  - New customers? New channels?
  - More or less profitable now? How and why?
  - Less or more expensive now?
  - Do you have any new of value?
  - Access to new recourses/activities/partner?

Business Model Canvas

- Customer segments (Doctors, patients citizens etc.)
  - For whom does the organization create value?
  - Who are the most important customers?
    - Any different from previous?
  - Value proposition (competitive price, ease of use, mobility)
  - Why does customers choose you? What it that create value?
  - What is it that makes you profitable?
    - Compared to previous?

- Channels (from mail/telephone to new IT-channels?)
  - Through which communication channels, our customers want to be reached?
  - With what channels do you reach out to them now?
    - Difference from before?

- Customer relationship (automatic, face-to-face meetings)
  - What type of relationship does your customers that you offer and maintain them?
  - What kinds of relationships do you have in the current situation? No new scheduled?
  - Development potential?
    - Difference from before?

- Key resources (human resources, expertise)
  - What are the main resources required of you so that you will offer your value proposition? Resources in the form of channels, relationships?
    - Difference from before?

- Key activities (Produce something, solving problems)
  - What are the main activities is necessary and required of you for you to offer your value proposition?
  - What do you perform the activities today? Any new news? Suggestions for improvement?
• **Partner network** (Acquisition of a particular resource or activity)
  - Do you have any partners / suppliers today?
  - What will you receive if for activities and resources from them?
  - Are you in need of new partners? Why? Plans to do so?
    - Difference from before?

• **Cost structure** (Fixed costs, variable costs, licenses)
  - What are your most significant costs today?
  - What resources / activities are most costly today?
    - Difference from before?

• **Revenue streams** (Basic fee, compensation from council etc.)
  - How do you earn money today?
  - In what ways - how to pay your customers today?
  - What makes you profitable?
Marknaden för vårddokumentationssystem
Sjukhus, psykiatri och primärvård
Antal användare 2013

Figure 8 - Overview of the largest EHR systems in Sweden as of 2013 (eHälsa i landstingerna, 2013)
Figure 9 - Geographical overview of Sweden’s EHR systems (Sjukhusläkaren, 2012)