

**HOW CAN WE IMPROVE OUR UNDERSTANDING OF SUCCESSFUL
IMPLEMENTATIONS IN eHEALTH?**

A thesis submitted to the University of Manchester for the degree of
Doctorate of Business Administration
in the Faculty of Humanities

2015

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Abstract

This research studies the interaction between eHealth and implementation success. eHealth has become an important subject of discussion and evaluation for healthcare organisations over the last decade or so, and has also been the focus of national healthcare programs and plans. Billions of pounds are being spent on implementations of eHealth. Those implementations endeavour to cut costs, while at the same time, achieving enhanced efficiency and accuracy. Hence, understanding success in eHealth has become an attractive topic for research and a requirement in healthcare practice. This research aims to understand the definitions and factors of success in implementations of eHealth. In doing so, it examined the suitability of the Delone and McLean Information Systems (D&M IS) success model to explain eHealth success.

A multistage research design was adopted. The first stage was composed of a thorough Systematic Literature Review that covered the origins and development of eHealth, the different themes in the research around eHealth, the concept of Critical Success Factors in IS, and the available frameworks for IS implementations, in general, and eHealth, in specific. As for the second stage, which constituted the core of this study, it was based on an exploratory, mixed-methods approach to research where a triangulation of research methods, data collection tools, and data sources was employed. As part of this approach, two case studies were conducted. Within the case studies, 20 semi-structured interviews were carried out; the outcomes of the interviews were analysed using framework analysis. In addition, a survey took place, and feedback from the survey respondents was analysed using different quantitative statistical methods. Finally, content analysis was relied on to examine all the relevant existing documentations.

This research found that information systems success models, already in existence, can facilitate the understanding of implementation success in eHealth. The D&M IS success model, in particular, was chosen and applied. The results of the qualitative and quantitative research showed that the D&M model is suitable to explain and define success in eHealth. In addition to the constructs that define success in eHealth, such achievement is attributed to a number of factors. This research found that eHealth shares a number of success factors with other IS implementation frameworks. At the same time, eHealth success factors that emerged from the case study, like; clinical engagement, the role of eHealth leadership, and clinical champions are discussed. This research led to the exploration of new factors that require a better understanding, such as; the effects of a national eHealth policy, the role of critical champions, and innovative methods of eHealth training. Links between eHealth success definitions, and success factors were investigated, as part of this study. The results of this research revealed statistically significant links between the achievement of organisational goals and user satisfaction, and ultimately, with implementation success.

This work has allowed for the development of a potential eHealth specific version of the D&M model as a provisional model to be confirmed with further research. It identified success factors that affect the implementations of eHealth. Some of the factors are eHealth specific, which can also be developed into a provisional model. In addition, this work has resulted in a number of recommendations for implementers and evaluators of eHealth in practice.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other University or other institute of learning.

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Acknowledgements

Thank you to the organisations that have allowed me to meet with them and develop the case studies through their experiences in implementing eHealth, namely Golden Jubilee National Hospital in Scotland, and the IB Salud group of hospitals in Spain. In addition, I extend my gratitude to all the organisations and individuals that gave their feedback and advice throughout the last five years, across the UK, the US, Europe and the Middle East.

Thank you to my supervisors, who have guided my investigation over the last five years, and taught me the art of research: Professor Naomi Chambers and Dr. Nathan Proudlove.

I extend a special thank you to Teresa Lojzer, who has helped me to edit this document. Finally, thank you to my colleagues and supporters at Allscripts and Orion Health for their encouragement and support.

Dedication

This thesis is dedicated to the soul of my grandfather, Ali Zarzour, after whom I am named. He did not get any significant formal education, yet started a business from Damascus, which spanned all the way to Tokyo in the East and Los Angeles in the West. I also dedicate this to my mother, Wafa Edelbi, who probably does not know much about eHealth, but has been my guardian angel through this, and all other endeavours, in my life.

Preface

The author's background has always been in business and management. His interest in technology, as a world changing industry, led him to a nine-year career with Microsoft. During that time, he got exposed to the 'Connecting for Health' national eHealth program in the National Health Service (NHS), and since then eHealth became his passion and the main drive behind his career. That force led him to work for two of the world leading eHealth solutions' providers: Allscripts and Orion Health.

His academic education has been business focused, and consisted of a Bachelor of Arts in Economics and Management from Marquette University, Wisconsin, USA, and an MBA from the University of Warwick, UK. However, his passion for eHealth and the desire to link his practical career with his research interest resulted in the decision to do this evaluation of eHealth.

The author selected this novel subject for his thesis, and decided to go through this long and demanding process of doctoral research, because he believes that it is of utmost importance to the development of the healthcare industry.

CHAPTER 1. INTRODUCTION

The focus of this thesis is the implementation of eHealth solutions. It attempts to address the characteristics of the successful application of eHealth initiatives, and how those interactions can be understood and replicated. eHealth information systems are, in principle, Information Systems (IS). The Implementation of Information Systems (IS) is an established field of research in IS and Business Management. As we will see later in this thesis, eHealth has also become an emerging field of research. This thesis looks at the intersection of Information Systems Implementation and eHealth.

1.1 Subject overview:

Through my twenty years of experience in Information Technology, I managed to identify what, in my opinion, is its most instrumental and impactful practice: eHealth. In today's world, where we spend more time online than we do interacting with others, where everything is connected electronically, and anyone can insert a piece of plastic in a wall, withdraw money and have no doubt that the correct amount was deducted from his or her account, one cannot ignore the fact that healthcare is not nearly as accessible. If someone falls sick or gets into an accident on the street, it is more likely that he or she will have to go through medical tests before a clinical team can accurately determine a prognosis about his/her condition or medical history. Undeniably, in many of such cases, it would be too late.

I am immensely interested in eHealth and have spent most of my career working in companies that provide eHealth, because I believe healthcare should be at least as agile and effective as banking. eHealth, which refers to the use of information and communication technologies (ICT) in healthcare has been defined by the World Health Organisation (WHO) as "the cost-effective and secure use of ICT in support of health and health-related fields, including healthcare services, health surveillance, health literature, and health education, knowledge and research" (World Health Organisation, 2005, p.121).

The applications of eHealth have been further classified, such as the use of eHealth in the provision of health services at a distance (telehealth), management of clinical and administrative information (health informatics), and sharing information and knowledge with healthcare providers, patients, and communities (e-learning) (World Health

Organisation, 2007). Out of the earlier mentioned classifications, this research is concerned with the management of clinical and administrative information. Similarly, over time, the WHO definition developed to focus on the information rather than on the tools: eHealth has been described as a means to ensure that “the right health information is provided to the right person at the right place and time in a secure, electronic form to optimise the quality and efficiency of health care delivery, research, education and knowledge” (World Health Organisation, 2012, p. 2).

In my research, I will look at enhancing the current available literature on eHealth through contributing to an adoption model (framework) to which hospitals can refer to when implementing eHealth strategies. The selected method of this contribution aims to contextualise one of the existing IS implementation frameworks into the field of eHealth. These frameworks are normally a blend of organisational, technical, and socio-technical (people and technology) aspects, which affect an IS implementation. To achieve this goal, in addition to researching existing literature, I will conduct a case study that attempts to successfully effectuate an eHealth scheme. In this case study, I will compare the organisation’s approach and choices, with established IS implementation frameworks. Consequently, I will suggest modifications to the existing frameworks to better suit an eHealth scenario. These suggestions would revolve around lessons learned, and the comparable aspects of the organisation, which can be modified according to certain criteria when applied to other organisations. The research starts with a pilot case study, and then moves to the main case study at Golden Jubilee National Hospital (GJNH) in Scotland, which is the core methodology for this investigation.

1.2 What is eHealth? Why is it important?

To begin with, this research attempts to identify the universe in which the field of eHealth studies resides. The health information technology industry identified IS as the universe and eHealth as a sub field of study, mainly referring to regional and national medical information systems that encompass hospital and facility medical information systems. However, in healthcare, the definition of eHealth is much broader than that of the above classification, which makes eHealth a field of study on its own with many potential applications. This distinction of eHealth as its own entity for research is clarified in the

definition given by Murray et al. (2010) as “the use of emerging information and communications technology, especially the Internet, to improve or enable health and healthcare”. Noting the discrepancies in the definitions of eHealth, it is indeed questionable if eHealth represents a discipline of research and knowledge, or just a term or an umbrella to label the research done around different related areas. Figure 1.1: Links eHealth to other related disciplines.

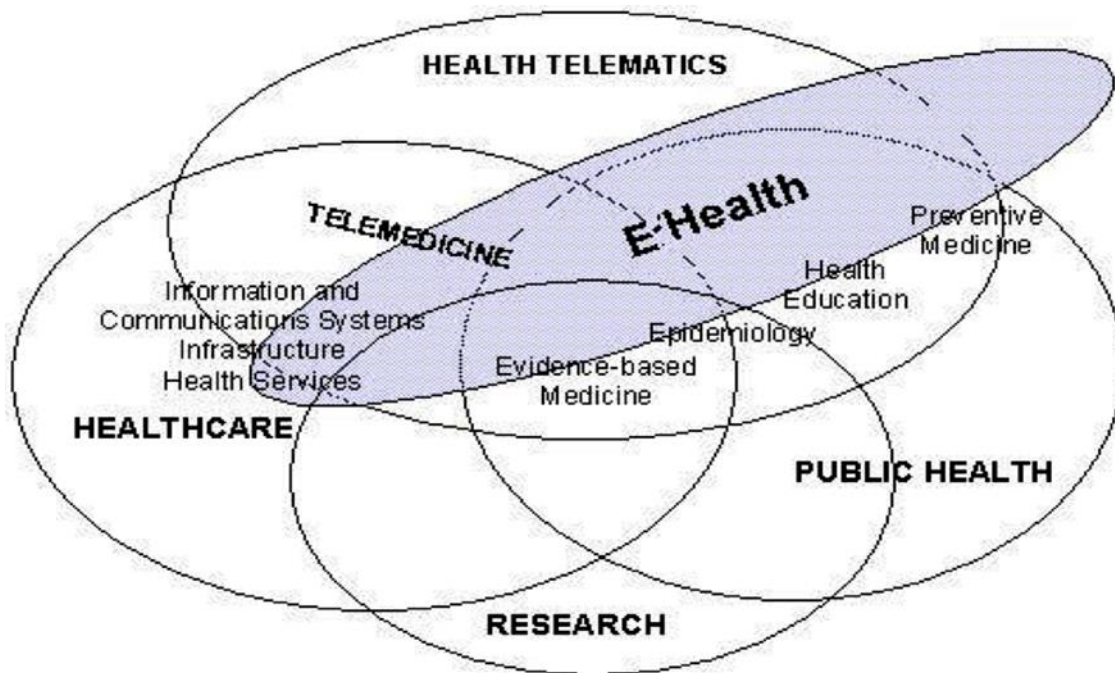


Figure 1.1: The position of eHealth relative to other disciplines (Wilson & Lessens, 2006).

It can be argued that studies of eHealth are associated with the availability of information and information management technologies. Similarly it can be argued that as eHealth is not a discipline of its own, as it is concerned with the use of information systems in healthcare, it falls under Information Systems (IS) as a field of study. Like other economic sectors and industries, especially those that are service related, the healthcare industry looks for ways to utilise such emerging tools and technologies to improve its quality, and achieve savings in both time and costs, related to the provisioning of its services. The difference between the healthcare industry and other industries is that it has been conservative by nature as it deals with the aspects of human lives, health, and wellbeing (Wickramasinghe et al., 2005) . This conservatism, coupled with the relatively time consuming, resource intensive process of studying and training in the healthcare industry, led to a relatively low level of availability of trained professionals qualified to work in

healthcare. Accordingly, the industry has been restrained in adopting new concepts (Huang et al., 2010) as change, itself, requires the involvement of other types of professionals in the healthcare provisioning service, including individuals such as engineers, statisticians, and information management experts. Hesitations discussed above are demonstrated in the low occurrence of the adoption of technology in the medical field compared to other industries like the financial industry, aviation, and logistics (Wilson & Lessens, 2006).

At the same time, the healthcare industry has faced serious challenges related to its conservative nature, described above, in addition to the demanding requirements of training healthcare professionals, and other factors related to the social and economic aspects of providing medical care (Swayne et al., 2012). Many publications, like Swayne et al. (2012), Moxham et al. (2012), and Vitacca et al. (2009) among others, address those challenges, which are summarised below. Those challenges were also discussed in the WHO's Global Healthcare Summit in November 2012. Some of those challenges are related to global macro factors like the dramatic increase in the world's population and the ageing population in many nations. Others are related to the healthcare industry itself, its management, policies, funding, and staffing; a summary of those challenges is outlined below.

A combination of the above-mentioned factors, as well as others, posed a serious challenge to the healthcare industry, as it could not continue to provide care to the global population using limited resources, and maintaining the same management strategies. Accordingly, it has become clear that the healthcare industry needs to become more efficient and accurate in providing patients' care. As one of the main tools of increasing efficiency, improving quality, and reducing errors, the use of information technology within healthcare became a necessity. As a result, Health Information Technology (HIT) has emerged as a priority in the healthcare industry (Oh et al., 2005).

eHealth has become one of the main priorities of the healthcare industry, which has been demonstrated through a strong focus of governments on HIT and health automation since the beginning of the 2000s. Globally, there are many examples of such focus. To mention a few, we can refer to the "Connecting for Health" project initiated by the National

Health Service (NHS) in the UK in 2004 (Jones et al., 2005), and “The Meaningful Use” eHealth funding that was launched by the Obama administration in the US in 2010. As well, the HIT focus is reflected in university and research institution foci on eHealth as a field of study, research, and professional certification (Swayne et al., 2012).

1.3 Drivers of eHealth growth

If healthcare was addressed as an activity similar to other industries, it would be fair to assume that healthcare can and should use information technology to improve its productivity and outcomes (Huang et al., 2010). Such a simple technical view of the subject can be seen in Intel corporation’s definition of eHealth: “a concerted effort undertaken by leaders in healthcare and hi-tech industries to fully harness the benefits available through convergence of the internet and healthcare” (Eysenbach, 2001). However, one can argue that automation does not start with information technology, but with a series of operational improvements and organisational readiness that would allow realising the benefits of introducing information technology to healthcare. Such a view is better reflected in the WHO’s definition of eHealth as being “the leveraging of the information and communication technology to connect provider and patients, and governments; to educate and inform healthcare professionals, managers, and consumers; to stimulate innovation in care delivery and health system management; and, to improve our healthcare system” (World Health Organisation, 2007).

One can argue that studies of eHealth were associated with the availability of information systems and information management technologies. Like other economic sectors, especially those that are service related, the healthcare industry looked for ways of utilising such emerging tools and technologies to improve quality, and achieve savings in time and costs related to the provisioning of service.

As previously stated, the medical field faced serious challenges related to the demanding requirements of training health professionals, and other factors related to the social and economic aspects of providing healthcare. Such challenges became main drivers behind eHealth growth and importance as addressed in publications like Moxham et al. (2012), Vitacca et al. (2009), and Wickramasinghe et al. (2005). The challenges are

summarised in the following list:

- Lack of sufficient numbers of trained medical resources on global basis; related to the demanding nature of medical training on human and financial resources
- Natural growth in number of patients on global basis, which exceeds the growth in numbers of medical resources and facilities
- Ageing populations related to improvement of care, and development of medications and methods of curing diseases
- Funding mechanisms of healthcare, and the questionable success of both socialised and private based health provisioning systems
- Wasteful nature of the healthcare industry, and the mismatch between interests of patients, providers, and payers

In addition to the healthcare industry related challenges, eHealth, or the use of HIT, has its own problems related to eHealth professionals and the workforce. Summarising those challenges, Smith et al. say that the:

health informatics workforce will require significant expansion to support national eHealth work agendas. Workforce issues including discipline definition and self-identification, formal professionalisation, weaknesses in training and education, multidisciplinary and inter-professional tensions, career structure, managerial support, and financial allocation play a critical role in facilitating or hindering the development of a workforce that is capable of realising the benefits to be gained from eHealth, in general, and clinical informatics, in particular. As well as the national coordination of higher level policies, local support of training and allocation of sufficient position hours in appropriately defined roles by executive and clinical managers is essential to develop the health and clinical informatics workforce and achieve the anticipated results from evolving eHealth initiatives. (2011, p. 130)

The importance of eHealth, and challenges related to it, was demonstrated in the pronounced concentration of governments on HIT and health automation since the beginning of the 2000s (Smith & Fund, 2008). That emphasis was reflected in the focus of universities and research institutions to find ways for developing and improving HIT, its

implementations, and adoption (Wickramasinghe et al., 2005).

1.4 Definitions

This thesis will adopt the wider definition of eHealth in terms of its scope. The definition of Murray et al. (2010) as “the use of emerging information and communications technology, especially the Internet, to improve or enable health and healthcare” is a suitable guide for this thesis. Under this definition eHealth includes any information system that is used in the provisioning or improvement of healthcare. This definition is used because of its wide scope, but not because it explicitly mentioned the Internet. Accordingly, the implementation of eHealth is the carrying out of any of such systems, as this thesis is focused on addressing the organisational and managerial aspects of eHealth systems’ executions, rather than the technical features of any specific system.

Similarly, this thesis will adopt a definition of Information Systems Implementation, which is more longitudinal and less focused on the technical aspect of the operation. The definition provided by Lucas et al. adequately represents the implementation of an Information System as “an on-going process that begins with the original suggestion for the application and continues as long as new users are introduced to the system” (1990, p. 5).

1.5 Research aims and questions

Informed by the different aspects of eHealth implementation success that resulted from the pilot case study, certain factors were highlighted as areas for focus. In addition to the review of the literature related to eHealth and its implementations, and the content analysis of available data and documents, I decided to pay close attention to the following issues:

1. eHealth and its implementations,
2. Success factors of IS implementations, and
3. Applying IS success factors to implementations of eHealth.

As I will explain in more detail later in this thesis, after a review of different IS success factors, I chose the Delone and McLean (D&M) IS success model to be tested and applied to an eHealth implementation through a case study. Accordingly, I can define my

research as follows:

- The field of research is eHealth
- The aim is to better understand eHealth implementations and their success
- The additional objective is to test the D&M IS success model through an explanatory case study research methodology

Based on the above, the research questions are:

- How do the factors listed by the D&M model affect implementations of eHealth?
- In what ways is the model applicable to implementations of eHealth?
- How might the model bring relevance, insight, and guidance to implementations of eHealth in practice?

1.5 Thesis structure

To address the research questions mentioned earlier, the thesis is organised into seven chapters, which are outlined as follows:

Chapter 1 introduces the research topic, research field, and key research questions.

Chapter 2 provides a review of the literature and the theoretical frameworks that are relevant to eHealth, IS implementations, and other aspects of the topic. In this chapter, the thesis goes through the key themes of eHealth research, the different aspects of IS implementations, in general, and eHealth specifically, and the main success factor models and frameworks. Chapter 2 also examines other environmental and organisational aspects of eHealth implementations, like; leadership, the national environment, and organisational structures.

Chapter 3 describes the research methodology. First, the ontological and epistemological perspectives for the research are established, including a discussion of positivism, interpretivism, and critical realism. The research methodology, which relies mainly on qualitative methods, is explained, and a rationale for selecting specific research techniques is given. Finally, the research design, data collection, and analysis methods are

explained.

Chapters 4 and 5 present the results of the research. Specifically, Chapter 4 investigates eHealth through an explanatory case study at GJNH. This case study provides a foundation for examining the identified characteristics of eHealth implementations and the main related themes that emerged from the literature review and pilot case study. This chapter also outlines the qualities of successful IS implementations identified in the D&M model. The framework analysis method was used to analyse the content derived from the interviews and other supporting documents provided by GJNH. Chapter 5 presents a survey, which further examines the findings from the explanatory case study. The questions of the survey are produced based on the findings of the explanatory case study to establish the required triangulation. Final conclusions are reached based on the triangulation and the consistency of themes throughout the research stages.

Chapter 6 represents a discussion of the findings of chapter 4 and 5; it links the results from qualitative research with the results from quantitative research. It also links the findings, as a whole, with the theoretical background of this research, and lists some of the limitations.

Finally, Chapter 7 describes practical, and theoretical contributions of the investigation, and identifies areas for further exploration.

CHAPTER 2. LITERATURE REVIEW

The following chapter provides an overview of the literature on the topics of this thesis around eHealth. It explores the main themes that were identified in eHealth literature and other related subjects like HIT. Critical success factors in information systems implementations and eHealth implementations are discussed, as these factors were the impetus for the formulation of the research questions. In order to ensure that the research questions are covered by a wide range of theoretical and methodological approaches, different bodies of literature were reviewed. This chapter starts by reviewing the origins and development of eHealth as a field, followed by an exploration of the different themes in the research around eHealth. The second part researches the concept of Critical Success Factors in IS. The available frameworks for IS implementations, in general, and eHealth, specifically, are investigated. The D&M IS implementation success model is described and discussed as the theoretical base for the explanatory case study, and consequently the analysis of the findings.

2.1 Technical aspects of the literature review

2.1.1 The scope

The literature search went through two phases: the preparatory phase to broadly explore the literature, and the main search, which was informed by the results of the pilot search. After going through the second round of literature review, the search focal point was slightly altered to centre on eHealth as a primary term versus HIT. As mentioned above in the introduction, the HIT industry's definition of the scope is somewhat different from that of the academic world. In the industry world, HIT is the main universe, and eHealth is a subsidiary that refers mainly to regional and national medical information systems encompassing hospital and facility medical information systems. On the other hand, in the academic world, eHealth is the universe and all other terms are represented within it. This distinction becomes clear in the definition of eHealth by Murray et al. (2010) that was adopted by this thesis earlier in the introduction: "the use of emerging information and communications technology, especially the Internet, to improve or enable health and health care". Accordingly, eHealth has a broad scope that encompass but is not limited to: (a) websites that provide health-related information for patients and professionals, including up-to-date medical information, and best practices, as well as, acting as a means of

establishing an introduction between patients and providers; (b) an online filing cabinet in which Electronic Health Records (EHR) can be stored, including; current, complete, and accurate information on individuals' medical histories; (c) Clinical Decision Support Systems that facilitate the determination of a diagnosis, the recommendation of remedies, while at the same time, when medically appropriate, permitting patients to keep track of their condition; (d) an automated system for internal policies and procedures in the field of medicine, along with a means for supplying important financial data called a Hospital Information System (HIS); (e) the opportunity to virtually link medical students and professionals, in addition to patients not just within the confines of their schools, practices, or clinic walks, but also to specialists, in particular medical fields, through Telemedicine or Remote Access Solutions; and also (f) national or public health registries to support studies in epidemiology and to develop preventative medicine. These above mentioned potential uses were used to identify keywords use in database research in the methodology section below.

2.1.2 The methodology

In the process of the literature review, which databases to search was the first issue to address. Since eHealth, and HIT are mixed fields, meaning that they have relations to health sciences and information technology, as explained in Chapter 1, the search could not depend solely on medical or health-related databases assuming that they would provide a comprehensive search on different areas related to eHealth. At the same time, IS sources could not be the only reference, as that would have led to overlooking the many related articles in medical journals. Consequently, the following databases were searched for the literature review: MEDLINE, CINAHL, PsychINFO, EMBASE, Google Scholar, and the EBSCO host Business Source Premier, which includes access to other databases that would potentially provide the publications necessary for the business aspect of eHealth. Those business-related databases include: IEEE databases, Emerald, Elsevier Science Direct Complete, Metapress Inderscience Publishing Ltd, EBSCO host Health Source Nursing Academic Edition, Gale Cengage General OneFile, EBSCO host Academic Search Premier, EBSCO host computer source, EBSCOhost Health Business FullTEXT Elite, EBSCOhost Health Source Consumer Edition, DOAJ Directory of Open Access Journals, Pro Quest 5000 International, Palgrave, and the ACM Digital Library.

A Systematic Literature Review was applied to comprehensively investigate and in turn concisely summarise the available literature on HIT and eHealth. The review focused on literature in the English language published between 1995 and 2013.

Criteria for inclusion in the study. To be included in the results the articles should be: (a) about eHealth, HIT, health ICT, Health Informatics, EHR, or EMR; and/or (b) should include information related to implementation or evaluation of eHealth. Specifics for the remainder of criteria for inclusion in the study are outlined as follows:

Field: Healthcare, Information Systems

Specialty: eHealth, Health information systems, Health and ICT, Health Informatics, EMR, EHR

Activity: Implementation, evaluation

Measurement: Systematic evaluation, expert judgment

Based on the above criteria, I used the contents of the Field and Specialty as key words in the Database queries. Such queries do not, in general, result in accurate versions of the specified outcome. A large percentage of the retrieved articles were not actually relevant to the research, although they contained one or more of the key words.

To acquire more relevant results, the Activity criteria were added to the systematic search. These criteria added two more variables, which including the reference to an implementation or evaluation. Although the research, in principle, is targeting all literature related to eHealth and HIT, the Activity criteria helped in excluding papers that were overly theoretical, or those pieces of literature that incorporated the key words, yet did not revolve around relevant concepts. After the systematic evaluation was applied, I introduced the final differentiator: expert judgment. By reading the abstracts, and in some cases, full articles I was able to exclude the pieces that did not fit the inclusion criteria, and accordingly, were not relevant.

The first level of inclusion, prior to the expert judgment, yielded slightly fewer than 1100 articles. After applying the additional criteria for inclusion, which are implementation

or evaluation, 185 relevant articles were identified.

2.1.3 The discipline

Although not as long established as other fields, there is an “eHealth,” “Health Informatics” or “Medical Informatics” tradition under Information Systems (IS) primarily concerned about the use of information technology in the medical field as highlighted in the definition above. However, a lot of what has been written came from the point of view of analysing patients’ behaviour under behavioural health, ways of improving productivity of healthcare professionals, healthcare management and economics, and healthcare policy and national planning (Warren et al., 2009).

In terms of methodology, the articles that were more focused on the implementation and benefits of eHealth and its practical application, which were the majority of papers, took more of an alternative criteria approach focusing on the internal relations between the phenomena in an inductive manner, depending less on quantitative than qualitative criteria partly because of the lack of quantitative research data that can be used in a meaningful way (Jones et al., 2005).

2.1.4 Limits of the study

This research is limited to the review of the evidence available in the English language about eHealth, HIT, and other related terms. Around 1100 titles were reviewed in the first round of inclusion. Eventually, the works were narrowed down and 185 articles were studied in the second round of inclusion. Most of the studies are based on analyses that are driven from small sample sizes. As the literature on eHealth is scattered, over a large number of research fields, the confidence in the ability of identifying all themes and directions of studies is not very high (Black et al., 2011). It should be noted that there could be publication bias with either mostly successful or miserably failing implementations of eHealth being advanced for publication. The search identified key words that are related to eHealth and of which I used a broad range. However, as there are copious variations of terms related to this topic, it is possible that some relevant literature might have been overlooked.

2.2 Main themes identified in eHealth research

In reviewing the different articles and pieces of literature in the different disciplines I identified above, and with the range of allied topic areas that touch upon eHealth, I came to identify some common themes. In addition to the themes, I identified different drivers and backgrounds related to each group of studies or articles. It seemed that besides the different themes, which will be analysed in more detail later on, the drivers are mainly socio-economic, trying to prove the value of eHealth, or in other cases, prove its existence as a discipline. Others are more technical, endeavouring to analyse actual experiences or implementation to draw conclusions or lessons learnt. Technical-based articles also aimed to measure improvements in quality and outcomes related to implementing eHealth. However, this part was the weakest in terms of its size relative to the overall literature, and its quality and value. Another weak area was drawing conclusions from successful and unsuccessful implementations to build guidelines and frameworks for future implementations. These two gaps created the initial focus of this research to try to highlight practices that result in positive outcomes and avoid ones that result in negative outcomes, and therefore demonstrate that merger in a potential framework.

In terms of the background, some of the articles took a positive stand considering eHealth as an affirmative addition to the process of health provision. Other articles were mainly negative trying to highlight the risks posed by involving information technology in health services. Table 2.1 depicts main arguments and themes across drivers and backgrounds.

Table 2.1: Classification of main themes, drivers and, backgrounds in eHealth literature

Discussion / Theme	Socio-Economic	Technical & Quantitative	Positive	Negative	Articles
Analysis of the field of eHealth and HIT, and its relation to other sciences.		•	=	=	(Murray et al., 2010) (Wickramasinghe, 2012) (Cruz & Garcia, 2013) (Ensio et al., 2006) (Warren et al., 2009) (Ahern et al., 2006) (Black et al., 2011) (Hans Oh et al., 2005)
Health Informatics can be detrimental for healthcare/ evaluating eHealth	•			•	(Ammenwerth & Shaw, 2005) (Khoja et al., 2012) (Han et al., 2005)
Health Informatics can help the medical field evaluate eHealth	•		•		(Thorp, 2010) (Murray et al., 2010) (Greenhalgh & Russell, 2010) (Lilford et al., 2009) (Biegler et al., 2012) (Vitacca et al., 2009) (Muñoz et al., 2007)
Stakeholders buy-in and social aspects of implementing HIT	•		•		(Carr et al., 2009) (Constantinides & Barrett, 2006) (Vitacca et al., 2009) (Sidorov, 2010)
Quality Criteria: Defining Health Information Systems		•	•		(Janssen et al., 2013) (Kossmann & Scheidenhelm, 2008) (Bleuer et al., 2012) (Deutsch et al., 2010)
eHealth implementations and evaluating eHealth implementations	•	•	=	=	(Goletsis & Chletsos, 2010) (Brendryen et al., 2013) (Murray et al., 2010) (Vitacca et al., 2009) (Lustria et al., 2011) (Mair et al., 2007) (Salzsieder & Augstein, 2011) (Peyton et al., 2007)
HIT adoption	•	•	=	=	(Moxham et al., 2012) (Thorp, 2010) (Wu et al., 2006) (Robertson et al., 2010)
National perspective of eHealth and building national eHealth	•	•	•		(Schiltz et al., 2013) (Thorp, 2010) (Morrison et al., 2011) (Cresswell & Sheikh, 2009) (Cresswell et al., 2012)
CPOE/Specific areas of HIT		•	•		(Nam et al., 2006) (Kaushal et al., 2003) (Niazkhani et al., 2008)
EMR/Specific areas of eHealth	•		•		(Hillestad et al., 2005) (Miller & Sim, 2004)
Health quality and HIT, and health outcomes		•		•	(Black et al., 2011) (Car et al., 2008) (Finkelstein et al., 2006)

The main themes identified from the literature search have been summarised in the

following:

Analysis of the field of eHealth and its relation to other sciences. Warren et al. (2009), like Cruz & Garcia (2013), Ensio et al. (2006), Oh et al. (2005), and others, attempted to scan the literature and investigate the existence of the field of eHealth. They discovered that it is very scattered across different sciences and publications. Articles around the field were distributed throughout medical journals, journals for specific professions within the medical field, like; nursing journals, journals of operations and management, journals of hospital management, in addition to journals of information technology and health informatics. Warren et al. (2009) conducted an overall systematic review of all literature written about eHealth, and drew main themes and conclusions. They used a methodology of systematically scanning a wide range of databases, and applying different rules of inclusion and exclusion. Then they passed the results to different teams of researchers and subject matter experts to classify various articles into more specific categories.

Evaluating eHealth value. As a relatively new and undefined field of study, many researchers evaluated the value and benefits of eHealth as a field and as a service. Many articles, like that of Vitacca et al. (2009), suggested that the use of health information systems can improve the process of delivering health services. To support their argument authors went into particular experiences in eHealth, and to historical scanning of the different occurrences and their perceived results. This positive view was mostly based on a general assumption that since eHealth involves the use of information technology to streamline a process and electronically manage information then, it is necessarily useful for the process and the management of information.

In a completely contradictory view, another group of researchers argued that just because eHealth is introducing information technology to the process of delivering care does not mean that it will make healthcare provision better. Authors, like; Ammenwerth and Shaw (2005) argued that the introduction of information technology may not only be poor in healthcare, but also it could theoretically result in killing patients. In support of their arguments, they addressed areas like taking the practice of medicine away for the human-experienced direct encounter. They also addressed technical issues like errors in the

electronic management of patients' data and the possibility of clinicians getting incorrect input that would negatively affect their clinical decision making process.

Social and organisational aspects of implementing eHealth. Several authors addressed the issue of the process of implementing eHealth involving many cultural and organisational factors, like any other implementation of information technology. Articles like those of Carr et al. (2009) and Constantinides et al. (2006) looked at different structural aspects like stakeholders' buy-in, executive sponsorship, clarity of goals, internal marketing, and others. The authors concluded that for eHealth projects to be successful, or even executable, a combination of organisational factors is required. As medicine is considered to be more complicated and demanding, than other fields, in terms of quality standards, such projects require a high level of maturity in terms of processes and information management independently from any introduction of information technology.

Vittaca et al. (2009) discussed the socio-technical effects of eHealth, and in particular, telemedicine, in involving the patient in the healthcare delivery process. They argued that for such involvement, there should be readiness on three levels: organisational, regulatory, and technological.

Defining quality criteria of eHealth. Similar to the debates around defining the field of eHealth, another dispute has emerged to define eHealth quality standards, what it is, and what it should be. As the field is not completely defined, there are no final agreed-upon criteria or quality indicators to what health information systems mean and should consist of.

Guedria et al. (2012) and Deutsch et al. (2010), like others, tried to define what should be considered a health information system. Under such definition, researchers addressed different parts of health information systems, most importantly the Electronic Medical Record, Electronic Documentation, and Computerised Physician Order Entry, to name a few. In addition, such studies tried to define the data sets that should go into each of those sub systems, including but not limited to; what defines an electronic medical record and what information should go into it. Such effort also led to a certain level or standardisation of medical data, which is necessary to achieve the general usability and

interoperability of health systems.

Related to such effort are those of the Health Information Management Systems Society (HIMSS) to define health systems, and the levels and stages of automation a health organisation can go through. Currently, HIMSS has seven levels of automation starting with level one, which is the least automated, and then progressing to level seven, where health organisations are fully automated with an interoperable system, and minimised use of manual processes and paper (paper light) (Palacio et al., 2010).

Evaluating eHealth implementations. The previous studies addressed the actual implementations of health information systems in a practical setting. Von Burg et al. (2008) and Niazkhani et al. (2008) looked at different implementations, and their related factors: organisational, economical, and technical. They also went into details like infrastructure readiness, project management approaches, and types of technology and implementation methodologies. They tried to identify common observations or success factors for similar types of organisations like mid-size community hospitals, or public sector hospitals in the Netherlands. Other efforts were made to target the evaluation of the overall state of eHealth in a country or across different countries addressing readiness, needs, obstacles, and results. Such evaluations are like the study conducted by Carlos III Institute of Health, and the Ministry of Health and Consumer Affairs in Spain titled “The eHealth Development Framework in Spain” (Peña, 2000) which focuses on Spain. Others, like the study conducted by the Information Society Commission in Ireland titled “An e-Healthy state?” (Coughlan, 2004), addressed the current state and future potential for eHealth in Ireland and across the European Union (EU).

Adoption of eHealth. A related subject to implementations, as those implementations were delivered, is the pressing issue of actual usability of the resulting systems, and adoption by targeted users. Chaudhry (2005) and Sheikh et al. (2011), among others, tried to address the issues around adoption of eHealth, and why health systems, even when implemented, are not widely embraced and utilised. Such studies addressed cultural factors of adoption, like; physicians’ habit to revert to manual practice and their unwillingness to change what they are used to in order to switch to electronic systems.

Other factors identified are technical, like; the availability and robustness of different systems, the ease of use and how intuitive is the user interface, and others, like political factors and job security.

Those studies identified a low level of adoption of health information systems, and consequently, tried to recommend certain practices to improve adoption. However, the general feel within the studies identified adoption levels as very low compared to that in other industries. This low rate led to the questioning of the value of eHealth all together. The national studies of evaluation, like the ones in Spain and Ireland, identified above, also addressed adoption but from a national perspective. On the national level, other issues arose, like; the availability of funding, physical infrastructure and connectivity, and legislation.

The national aspect of eHealth. As the use of information technology became more common within health organisations, another angle of it emerged, that is the national aspect. As more organisations become automated and manage health information electronically, the perceived value is hindered by the inability to exchange information among different healthcare organisations. Based on that assumption, different governments and research institutions worked on conceptualising and implementing a national health information platform in different countries or regions.

Morrison et al. (2011) and Kierkegaard (2013), like others, studied the national aspect of planning and implementing health information projects. Studies usually focused on one region or country's experience to draw conclusions and suggest recommendations. Those studies identified some required aspects of national systems like national health exchanges and national health records, and identified challenges and recommendations around them.

Specific Areas of eHealth. Different studies addressed specific areas of eHealth, or more specific systems or structures. As the field became wider, different studies focused on areas like Electronic Health Records and Electronic Medical Records. As an example, we will address Computerised Physician Order Entry and Electronic Medical Records.

Niazkhani et al. (2008), for instance, studied Computerised Physician Order Entry, which is the system that allows clinicians to place orders for tests, medications, and other care related requirements. They discussed its definition, use, the effect of its use, and recommendations. The general consensus is that the use of Computerised Physician Order Entry improves the delivery of care and reduces errors in practice. However, like the rest of eHealth, its usability and adoption is still under question. Specific experiences in particular organisations were studied to address positive and negative factors, and draw conclusions.

Lovis et al. (2011) and Vanagas (2011) studied e-Health or the national aspect of health records. Those studies, like others, went through the readiness, requirements, definitions, and implementations of national health records. Their conclusions identified serious challenges in the ability of implementing a meaningful e-Health strategy on the national level. Such conclusions are consistent with the arguments that these trends are the latest in the field and are not yet mature. Those conclusions are also consistent with experiences observed by the NHS of the UK and similar organisations in the United States.

eHealth and its relation with health quality and outcomes. Going back to the basics and essence of considering eHealth in the medical field, one of the questions that came naturally was: does eHealth improve healthcare quality and outcomes?

Logically, the reason for going through the whole effort of identifying what health information systems are, identifying their standards, and their implementation success factors, is to deliver systems that are utilised, and which use results in improving quality and outcomes. The earlier statement, although logical, is not very consistent with practical experiences in the health field. Accordingly, different studies tried to identify and quantify the link between implementing eHealth and the improvement in outcomes.

Some studies, like; Wu et al. (2006), tried to identify this link between eHealth systems and the different outcomes of healthcare: clinical, financial, and/ or organisational. In those studies, specific implementations were studied to identify any correlation between those implementations and the change of outcomes, whether positive or negative. The

problem with those studies is that they lack a certain element of generalisation. They also have not linked certain aspects of the implementation to the actual change of outcomes, if any (Black et al., 2011). Such studies were also much lower in quantity relative to other literature reviewed in this study. Kwankam summarises this weakness in quantity and quality of research linking eHealth with outcomes:

Despite the significant potential of e-Health systems to improve health, the evidence of the impact of ICT on health is thin. An important task for WHO is to stimulate development of the evidence base worldwide, through a global observatory on e-Health systems. The observatory would also track developments in relevant fields by collecting and analysing data on ICT and health, covering developments in research, industry, policy, and practice. (2004, p. 802)

The findings of this literature search were not far off from the findings of Pagliari et al. (2005) in their scoping exercise to map the field of eHealth. However, they categorised eHealth research according to two main groups: technology and content. Existing academic and wider evidence based references showed the scope of eHealth as a concept, the value of eHealth innovation, implementation challenges, and future directions for eHealth. The technology category included:

- Decision support tools for patients and clinicians;
- The use of network digital technologies (the internet) by patients (to seek information, self-managed care, or to seek peer support), and by healthcare professionals (professional networks, education and training, communication with patients);
- Computerised patient records, and related issues of confidentiality, patient controlled records, and effects on the delivery of care; and
- Telemedicine and tele-healthcare.

As for content areas, the categories included:

- Specific research needs (evidence of success in specific areas);
- Generic research needs (methodological challenges, issues with implementation, results on behaviour and relationships, educational interventions, health disparities,

- unconventional delivery media, function in self-care, and patient empowerment);
- Challenges for implementation (establishing impact, management support, strong project management, stakeholder engagement, the digital divide, ensuring reliability and quality, ethics, security, and privacy debate standards); and
 - Emerging trends and future directions (bespoke and custom-made systems, new technological advances in information management and care process, and delivery models).

Jones et al. (2005) built a different model of eHealth research based on stakeholder discussion and policy review. This model is unique in its orientation as it addressed the research agenda and priorities of eHealth, not only for existing research, but also for future research. In their exercise to define the scope of eHealth, they categorised the research questions identified by stakeholders and policy reviews. Six category groups were identified. Four of them are related to the scope of eHealth. The other two address the principles of research and development, and stakeholder hierarchy.

The use of information is the first group of scope defining categories. The information is used in decision support and the management of services, for support of service providers and patients, and in information-based treatments. A large number of research questions identified for eHealth research constituted the second group and were about sharing information. This sharing of information is across sites and sectors, and between different providers and patient groups. The third area is controlling information, which incorporated issues of control, accessibility, reliability, confidentiality, security, ownership, and regulation. The last group of scope defining criteria is processing information, which addresses a wide span of areas, including; how best to present information and user interfaces, where information might be presented, through which medium and which devices, and the synchronised integration of information generated from a variety of sources, as implemented in computerised ordering and home delivery of medications.

The identification and implementation of best practice in eHealth is an important area of identified potential research. This addresses the introduction of innovative

approaches, best practice procedures and challenges to implementation, training innovation, telemedicine, cost and benefit analysis, and other similar areas. The final category is about establishing a category of stakeholders' concerns. The main concern of stakeholders is the effectiveness of money spent on eHealth, and its impact on outcomes. In addition, stakeholders prioritised themes related to controlling information (responsibility, reliability, regulation, accessibility, confidentiality, security, and ownership), which formed the second level of a hierarchy of concerns. Figure 2.1 depicts the scope of eHealth research and its relation to stakeholders' priorities.

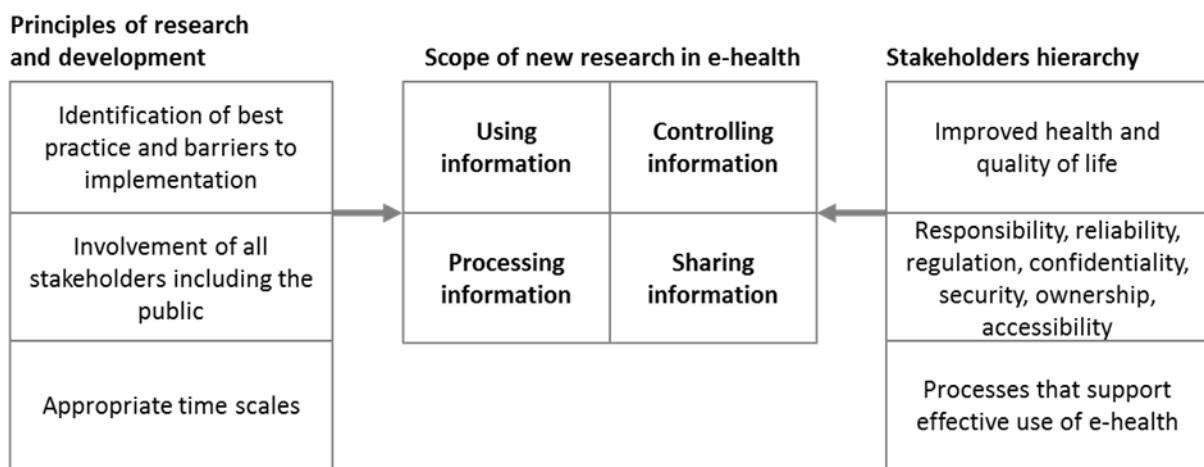


Figure 2.1: Scope of eHealth research adopted from Jones et al. (2005).

Clearly, this study targets one of the identified research priorities in the model, which is the identification of best practice and barriers to implementation.

2.3 Implementation success factors

This section will present a number of factors that were associated with success in eHealth literature related to implementations. The success factors selected are neither exhaustive nor conclusive in terms of relevance and importance of certain factors. They are listed because they were mentioned frequently in the implementation literature, and appear to complement success definition in the literature.

2.3.1 eHealth implementations and leadership

eHealth and leadership have been studied together in many instances. The majority of those studies do not investigate the roles of administrative and clinical, healthcare leaders in the success of eHealth implementations, which is the area this thesis would like to

explore. However, the role of leadership in eHealth implementations and in the operational phases was discussed extensively. Boonstra and Broekhuis explained the role of leadership during eHealth implementations:

Strong management and leadership in the organisation are essential to guarantee consistency between the strategic goals of using the technology and what the individuals within the organisation are working towards. To insure that, there should be a clear and pragmatic assessment of benefits and trade-offs, which would be communicated to users. That assessment needs to include timeframes, interoperability considerations, and suitable implementation approach for the technology and organisation. It is also the leadership responsibility to plan for potentially extreme emergencies, like a complete failure of the technology. (2010, p. 231)

One of the areas that the systematic literature review has revealed is eHealth as a skill and a competency that today's healthcare leader should acquire. With today's changing and developing environment of provisioning healthcare, leaders of the field cannot be effective without having a certain level of proficiency in using and understanding eHealth systems. Kennedy and Remus (2012) recommended that nurses should be recognised and positioned as the most qualified to respond to the current changes in the health system as part of the eHealth transformational agendas. As the goal of eHealth is to deliver better healthcare that is patient-centric, results-oriented, integrated, and sustainable, achieving such goals is increasingly dependent upon information technology. Accordingly, nursing skill sets should continue to match the requirements of the evolving healthcare system, which is focusing more on outpatient care, and requires medical providers to function as teams, and assume management roles in ensuring the continuity of care both in and out of the hospital.



Figure 2.2: The study of Human Factors Model. Source: Human and Organisational Dynamics in eHealth Bengert et al. (2005, p. 7).

Other research focused on the actual organisational and cultural aspects of eHealth implementations. Leadership comes at the heart of those cultural and organisational factors. Different studies addressed those areas, like that of Bengert et al. (2003). Their research titled, “The Role of Organisational Culture in the Management of Clinical e-health Systems,” addressed the different aspects of organisational culture, and their relation to eHealth success reaching to their model explained in Figure 2.2 above. In doing that, they researched across two sets of distinctive countries according to the different levels of uncertainty avoidance and organisational culture. The first group is characterised with high uncertainty avoidance; those are cultures in countries like South Korea, France, and Japan. The second group is characterised with low uncertainty avoidance; those are cultures in countries like US, UK, and Singapore. The results showed that in the first group, eHealth success was related to: (a) having clear rules to follow, (b) maintaining a loyal fellowship, (c) executing objectives correctly, (d) eliminating ambiguity, (e) actualising the motto, “Practice

makes perfect”, (f) making no errors or mistakes, (g) being trained to follow formulas, and (h) identifying a strong leader.

Where leadership came as one of the factors, in the second group, through survey analysis, it was found that leadership came in first of the factors affecting eHealth success. Those factors were as follows: (a) involving leadership, (b) being technology champions, (c) maintaining open and free communication of mistakes and successes, (d) having free two-way communication, (e) embracing the desire to experiment with new ideas, and finally, (f) harbouring a love of diverse approaches.

Bernstein et al. (2007) identified leadership as one of the main constants of information technology adoption in healthcare. The role of leadership becomes especially important for the success of new IT projects in the healthcare organisation when other challenges are experienced with constrained financial resources. Bernstein et al. (2007) also quoted Rogers’ assertion that success in the adoption of innovations depends on close work with opinion leaders (Rogers, 2003).

2.3.2 eHealth and change management

Resistance to change is one of the main factors that hinder the success of eHealth implementations. This resistance comes from groups and individuals. Individuals resist change for different reasons. Those reasons include, narrow self-interest as some individuals may lose status or privileges; resentment, which can be with individuals leading change or with content of change; different perceptions of change according to the individual’s role in the organisation; misunderstanding or lack of trust; and a low acceptance for change. When it comes to group resistance to change, it is a result of feeling vulnerable in the group structure or disturbance of social professional patterns. Accordingly, leaders of eHealth implementations need to be aware of potential sources of both individual and group resistance, and adopt a careful approach in dealing with such opposition (Mair et al., 2007).

Change management is core to eHealth implementations. Boonstra and Broekhuis (2010) regarded it as an essential component, and they concluded that:

... The process of EMR implementation should be treated as a change project, and led by implementers or change managers, in medical practices. The quality of change management plays an important role in the success of EMR implementation... A careful diagnosis of the specific situation is required before relevant interventions can be determined. (p. 231)

Different social networks emerge during an eHealth implementation. Those can be at the hospital level representing professional groups and departments, or at the national level for groups of hospitals, trusts, or regions. Each of these networks should be targeted separately as different groups have different interests and motivations related to the eHealth system. Mair et al. (2007) elaborated further on how this targeting can be achieved using a specific system which is NHS CRS:

Utilising informal social peer networking in influencing end-user perceptions of a new application is likely to be important in this context. This may take the form of demonstrations given by colleagues from early adopter sites, workshops, or meetings attended by enthusiasts from the same profession, or those who have knowledge of how to use the NHS CRS speaking about their experiences. Ideally, key players to be targeted are influential individuals (such as; managers, consultants, or senior nurses) who are similar to future users (e.g., from the same profession) and have experience of using NHS CRS prototypes... NHS CFH may also wish to consider setting up a social network around the NHS CRS in order to promote sharing of ideas and experiences. The appointment of clinical leads is a good start, but this is nationally led, rather than locally, which may pose difficulties in cultivating the local networking that appears particularly important. (p. 157)

2.3.3 eHealth and champions

The concept of the champion has been discussed extensively in literature that addressed eHealth implementations. The presence of a champion or champions in eHealth implementations is becoming a necessity. Lorenzi et al. explained:

A champion is an absolute necessity for a successful implementation. The optimal approach is to identify one of the most *clinically-respected* providers who has technology knowledge and who is committed to an EHR to fulfil this champion role.

A practice champion provides direction and inspires, encourages, promotes, and creates trust in the process, and in the future. In return, everyone in the practice needs to trust, respect, and communicate effectively with the champion. Champions must provide a combination of control and flexibility to create the highest likelihood of implementation success. (2009, p. 15)

Cresswell et al. agree with this view about champions and call them 'boundary spanners':

The appointment of clinical leads and 'boundary spanners' can be effective as these individuals often have an insight into 'both worlds': management and clinical. Indeed, we found the use of such local champions to be valued by system users and hospital management. As a result, their expertise and influence were harnessed where possible. (2011, p. 199)

Those 'boundary spanners' not only connect management with clinicians, but also with other stakeholders. Additionally, they play a role in designing workflows and training. Cresswell and Sheikh elaborated by adding that:

... Available evidence highlights the importance of senior leadership and lead professional (or "champion") support, resulting in greater ownership surrounding implementation activities. These champions frequently need to act as "boundary spanners", bridging the gulfs that often exist between and within information technology staff, management, and clinicians. They can also facilitate the re-design of workflows, provide adequate training and support to users, and highlight problematic issues. (2012, p. 27)

2.3.4 eHealth and organisational culture

Organisational culture has been discussed, on different occasions, in relation to eHealth implementations. First, the size of the organisation has to do with eHealth implementations. Larger, more complex healthcare organisations have been found specifically responsive to the introduction of eHealth solutions. This is partly related to their relative capacity in terms of financials and human capital, in addition to the availability of processes and management capabilities, and also their complex management structures

with great degrees of hierarchy. Cresswell et al. (2012) elaborated, noting that:

Strong organisational leadership and management are necessary to ensure strategic consistency (i.e., to that individuals within organisations are working towards the common goal of successfully utilising the technology). The literature shows that a pragmatic assessment of the likely benefits and trade-offs needs to be conveyed to users as part of this, including anticipated timeframes. Additional considerations should comprise the avoidance of 'scope creep', interoperability considerations, and the appropriate implementation approach suited to the technology and organisation in question (for example, a slow and incremental "soft-landing" or a one-off "big bang"). Throughout this process, management also needs to plan for potentially extreme contingencies, such as the technology failing. (p.27)

Scope and complexity of the solution can also affect its potential in the organisation. Yusof et al. (2008) talked about the importance of alignment or fit between three dimensions during implementations: technology, human, and organisational. This alignment seems much easier to reach in small-scale, organic, incrementally developed systems, in contrast to the larger more complex eHealth projects, which have been introduced lately, or almost enforced into complex organisational environments (Cresswell & Sheikh, 2012). The alignment between the different factors allows new innovative ways of working to emerge. Cresswell and Sheikh elaborate that:

... For a new technology to become effectively embedded in an organisation, there needs to be a reciprocal relationship between technical, social, and organisational factors in which new, often unanticipated, ways of working are allowed to emerge. This perspective may be challenging for linear implementation approaches, but unless such experimentation and re-invention is allowed, and indeed encouraged, technology may never fulfil its potential. Although a time-consuming and expensive process, evaluation of unanticipated consequences is therefore important. This should include evaluating consequences which may ultimately prove to be advantageous and also those which may inadvertently increase the risk of harm. (2012, p. 29)

Cresswell and Sheikh (2012) concluded that the fit between technical, social, and organisational factors is important to ensure that new technical innovations are not only usable and useful, but that they also support the organisations within which patients and professionals operate. Those dimensions or factors are inter-related, which requires analysing the reciprocal relationship of different technical, social, and organisational features at each stage of implementation. Those interactions are depicted in Figure 2.3, below.

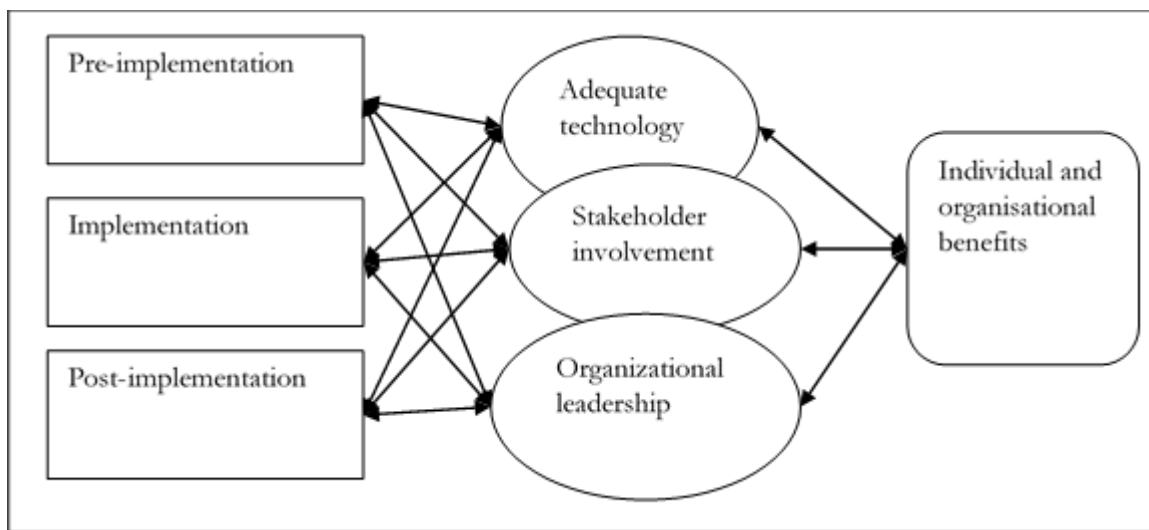


Figure 2.3: Inter-related technical, social and organisational factors over time in HIT innovation, Cresswell & Sheikh (2012, p. 30)

2.4 Critical success factors framework

As the research aims and questions will focus on critical success factors of implementations in eHealth, the systematic literature review was expanded to explore existing success factors frameworks. What follows is a summary of that literature study.

According to Christensen (2006), theories are improved by checking whether the same correlations exist between attributes and outcomes in different sets of data than the one from which the hypothesised correlation was induced. Such a methodological approach will be the base through which this research will apply a framework or typology, like the D&M model, into an eHealth implementation to test how the factors described in the model are applicable.

As above, this research aims at deductively examining the applicability of a success model to eHealth implementations. Therefore, the researcher studied relevant literature of the existing critical success factors frameworks. The study started with searching for “Critical Success Factors in eHealth Implementations”. Yielded results were limited and did not seem to be sufficient for building a proper understanding of such frameworks. Accordingly, the search scope was extended to address “Critical success factors in IS Implementations”. As a result of this expansion of the inclusion criteria, more resources were identified. Analysing the search outcomes showed that most of the resulted frameworks were addressing the implementation of a specific IS solution like ERP, development platforms, and banking systems. A smaller number of articles addressed frameworks for IS implementations, in general, and an even smaller number of articles addressed such frameworks in implementations of eHealth or Health Information Systems.

Based on the relevance, quality, and content, a number of frameworks to potentially be used in this research were identified. The focus of the selected papers reflects the corresponding occurrence of their domain within the overall Critical Success Factors search.

Below is a Table (2.2) that lists the selected frameworks and compares them across the variables of scope, methodology, and relevance.

Table 2.2: Major IS frameworks selected.

Framework	Scope of the solution	Methodology	Relevance
(DeLone & McLean, 1992) (Delone, 2003)	IS implementation in general	Analysis and synthesis of empirical and conceptual models of IS success	It is a general model for IS success, not specific to any solution or industry. It addresses success factors of IS implementations and the relations between them. Being more general it might lend itself for application in an eHealth scenario. It is widely applied and used in different types of IS implementations, and is also widely cited in many respected articles and journals.
(Holland & Light, 1999) “Critical Success Factors Model for ERP Implementation”	Implementation of Enterprise Resource Planning solutions	Case Study Methodology	It addresses CSF of an IS system implementation. ERP is like eHealth in the sense that it is a specific solution within the IS arena. Many lessons in implementing ERP can be passed to the implementation of eHealth. It is also relevant from a methodological point of view as it uses a Case Study methodology.
(Hong & Kim, 2002) “Critical Success Factors of ERP Implementations: an Organisational fit perspective”	Implementation of Enterprise Resource Planning solutions	Quantitative analysis	It addresses CSF of an IS system implementation. ERP is like eHealth in the sense that it is a specific solution within the IS arena. Many lessons in implementing ERP can be passed to the implementation of eHealth. This research focused on the Organisational Fit aspect of

			the implementation, which can add a new perspective to my research.
(Altameem, Zairi, & Alshawi, 2006) "Critical Success Factors of eGovernment: A proposed model for eGovernment implementation"	Implementation of eGovernment services	Review of reviews, and Model building	It addresses CSF of an IS system implementation. eGovernment is related to eHealth, and some might argue that eHealth is a specific area of eGovernment, especially when we look at the public service side of it. Many lessons in implementing ERP can be passed to the implementation of eHealth. This research introduced a different set of factors of eGovernment implementation and constructed a model around it to guide towards success, including: Governing Factors, Technical Factors, and Organisational Factors.
(Esser & Goossens, 2009) "A framework for the design of user-centred teleconsulting systems"	Design methods and recommendations for delivering a user focused teleconsulting system	Qualitative analysis	It studies one of the solutions under eHealth. It is building a framework to assist researchers and designers when designing a telemedicine solution, which requires some background of how those systems are implemented.
(Pagliari, 2007b) "Design and evaluation in eHealth: Challenges and implications for an interdisciplinary field"	Design and evaluation of eHealth systems, and focusing on the interdisciplinary nature of the process and its different aspects.	Qualitative analysis	It develops a framework to evaluate eHealth. In this framework certain aspects of implementations are mentioned like adoption, interdisciplinary approaches, and user acceptance.
(Dansky et al., 2006) "A framework for evaluating eHealth research"	Evaluation of eHealth research using specific examples of eHealth technology.	Qualitative methods	One of the main objectives of the research is to help the researcher understand obstacles experienced when implementing eHealth. It also gives researchers input around building and evaluating eHealth programs.
(Kaufman et al., 2006) "Applying an evaluation framework for health information system design, development and implementation"	Application of an evaluation framework to eHealth systems, their design, development, and implementations	Qualitative methods	It addresses eHealth systems' implementations. It also focuses on eHealth potential in improving clinical process and delivery.
(Yusof et al., (2008) "An evaluation framework for health information systems: human, organisation and technology-fit factors"	Evaluation framework of health information systems, addressing human, organisational, and technology related factors	Qualitative methods and case study	It is a framework for evaluating design, performance, and impact of eHealth, which are related to the success of eHealth. It also used the D&M IS success model, which is one of the most established models of IS success.
Abdullah (2012) "Hospital Information System Implementation: Testing a Structural Model"	Implementation of Hospital Information System	Quantitative analysis	It tests an IS implementation model. From a content point of view, it tests a model of implementing IS in a Hospital Information System. It tests sample implementations against the established D&M IS success model.

In reviewing the different Key Success Factors frameworks identified above, this research analysed the differences and similarities between them, and assessed their suitability to the purpose of this research.

Both Holland and Light (1999), and Hong et al. (2002) studied success factors for the implementation of the same IS solution: enterprise resource planning. However, each of the two studies focused on different aspects of implementation. Holland and Light used the case study methodology across different industries to understand the main actors affecting the implementation of Enterprise Resource Planning (ERP) in different organisations. As a result a list of factors was generated, and was broken down into two main categories as per Figure 2.4, below.

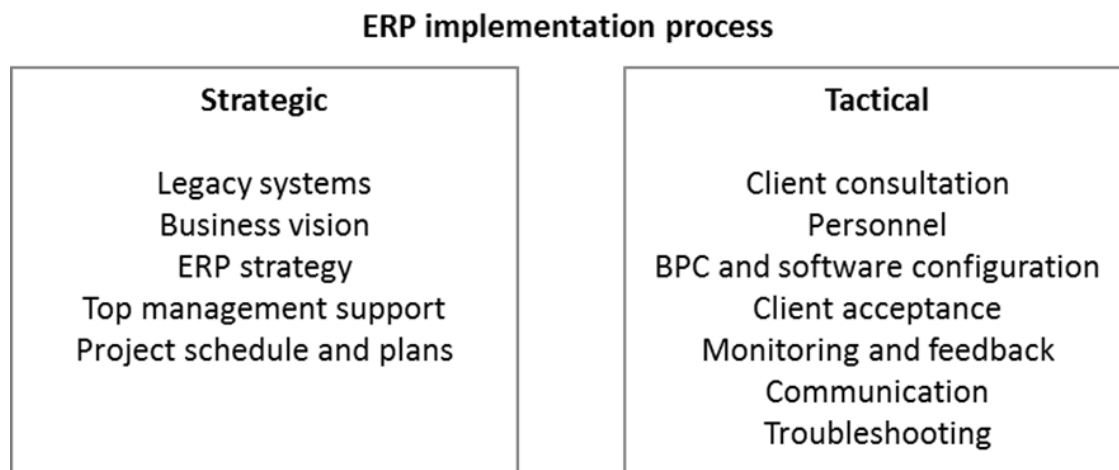


Figure 2.4: Holland et al. (1999) Critical Success Factors model with critical and tactical factors

Hong et al. (2002) addressed the organisational fit aspect of ERP implementations. They argued that the success of an ERP implementation is related to the degree of the organisational fit of the institute in which it is implemented. They linked different organisational aspects affecting the implementation, with different variables of organisational fit, and the ERP implementation success as per Figure 2.5 below.

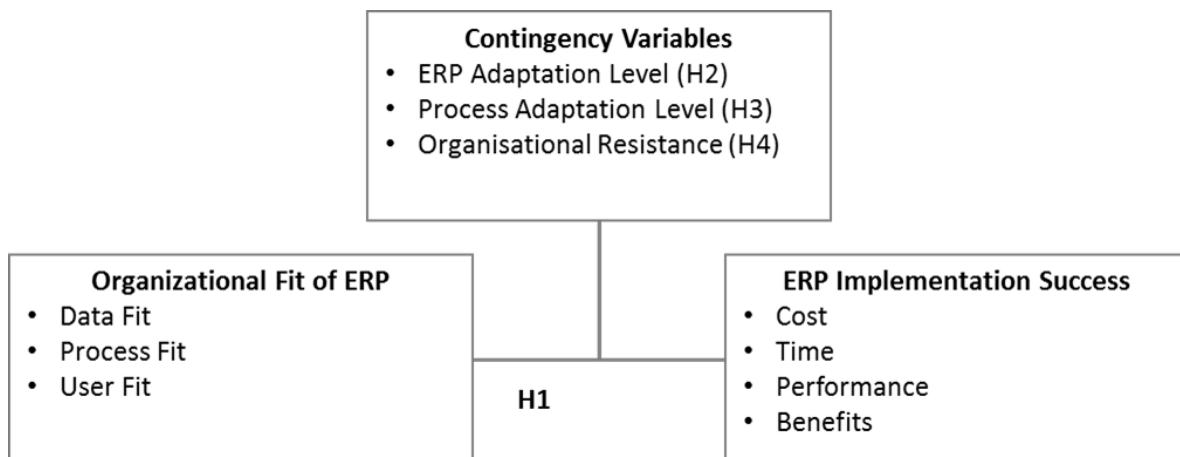


Figure 2.5: Organisational fit and ERP success (Hong et al., 2002, p. 25)

Both studies represent interesting opportunities of applying the same areas of implementation success to eHealth. Holland and Light (1999) seemed more suitable as it used case study as a research methodology. However, as both are ERP specific, which studied mostly commercial and industrial organisations, this research continued to look for other frameworks that could be potentially more suitable for my purpose.

Another area that can arguably be closer to the implementation of eHealth is eGovernment implementation. The similarity comes from the consideration that both fields are relatively recent, and address a wider audience in terms of stakeholders and users in comparison to ERP, which is primarily a financial system. Altameem et al. (2006) addressed a wide range of success factors of eGovernment implementations. They broke it down into three groups: Governing Factors, Organisational Factors, and Technical Factors, as per Figure 2.6 below. The interaction between the different groups of factors, and the degree of each group of factors' impact determines the overall success of the eGovernment implementation (Altameem et al., 2006). Those categories also make it easier to focus potential research. The richness of this model and its comprehensive nature are valuable. Yet, the fact that it has an extensive range of variables that need to be tested for its application to eHealth, makes its reliability questionable, especially within a case study research design. It also was prepared based on research in eGovernment implementation, which arguably can be different from eHealth in relation to some particularities of the

medical practice.

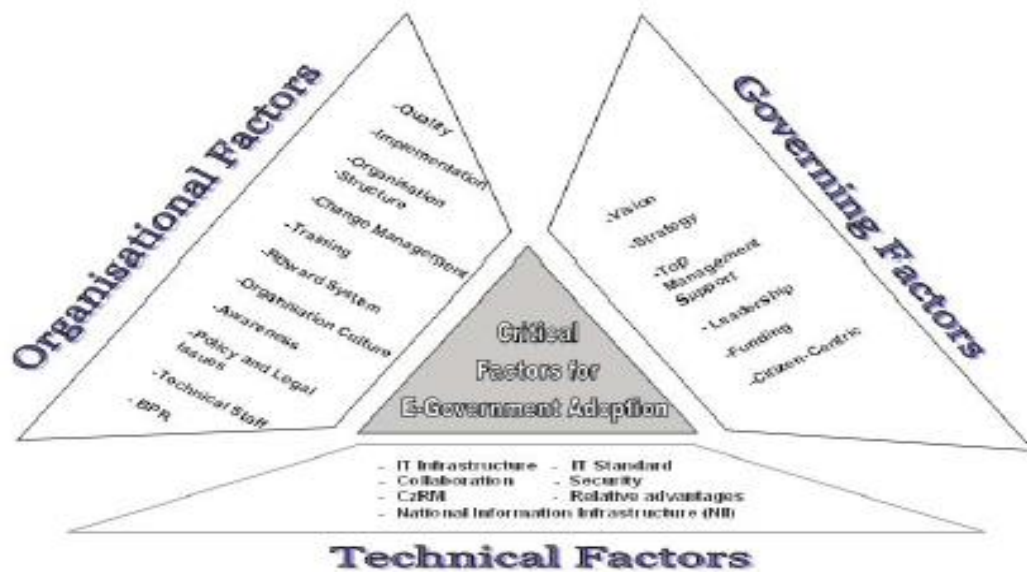


Figure 2.6: Altameem et al. (2006) Key Success Factors in eGovernment Implementations.

Although very few CSF models were found in a healthcare setting, some were of good quality. Esser and Goossens (2009) developed a framework to assist in the design process. It targets primarily design professionals to help them in understanding the factors that affect users' requirements and satisfaction with the system, which ultimately lead to acceptance. However, the authors made it clear that their work was specifically targeting tele-consultation only.

Pagliari (2007) discussed the similarities and the common techniques between software design and development, and the delivery of medical services. She highlighted the importance of the iterative development approach used in software development; some of its aspects are used in clinical processes. She built an evaluation framework, which can be used to evaluate and improve eHealth systems. However, the focus of the framework was on the development process and the interdisciplinary nature of it.

Dansky et al. (2006) put together a framework for evaluating eHealth research that targeted eHealth, in general, in its broad definition, which is adopted by this research. Yet it took specific examples to study, like telemedicine. Although, one of its goals was to help

researchers understand how to overcome obstacles in implementations, the focus of the framework is clearly on the eHealth research, and not on eHealth implementations and their success.

Kaufman et al. (2006) built an evaluation framework for eHealth systems' design, development, and implementation. They addressed eHealth potential in positively influencing the healthcare process. They also clarified evaluation required in each phase of system development. However, the main focus was on researchers and structuring research in eHealth, in addition to system development.

Yusof et al. (2008) presented a framework that aims at helping researchers and practitioners to understand the complexity associated with health information systems' evaluation. They focused on hospital information systems, their performance, effectiveness, and impact. In doing so, they used the D&M IS success model, in addition to other models like the IT-organisation fit model. Although they have used the D&M success model, they neither focused on success definitions nor on analysing success. Rather, they used it as one of the components and building blocks to reach an evaluation framework.

Abdullah (2012) assessed the success of hospital implementation systems in Malaysia. He also used the D&M success model, however, in doing so he conducted a quantitative analysis. He linked the definitions of IS implementation success with the Key Success Factors they hypothesised. Those implementation success factors are illustrated in Figure 2.7 below. He empirically proved that those Key Success Factors were related with implantations' success (Abdullah, 2012). Compared to the frameworks above, this one seemed more suitable for this research as it was conducted in a healthcare setting. However, its qualitative methodology, and its focus on healthcare organisations in Malaysia offer some challenge to its suitability. Its value was very clear in two areas: (1) it summarised specific variables of implementation success that can be applied to a case study, and (2) it applied the well-established D&M model, which is widely used across different IS implementations. It also gave a practical example of using the D&M model in a healthcare setting.

The above progression of ideas led to the choice of the model for this research. This research will apply the D&M model to the case study. This approach will result in more value as it will apply this established IS implementation success model in its original form, rather than one of its adaptations, as none of which seemed to be a complete fit with the objectives of this research. At the same time, the success factors produced by Abdullah (2012) can be used in the interviews conducted as part of the case study. This way, more variables would be tested, and relations between the success definitions and success factors would be explored.

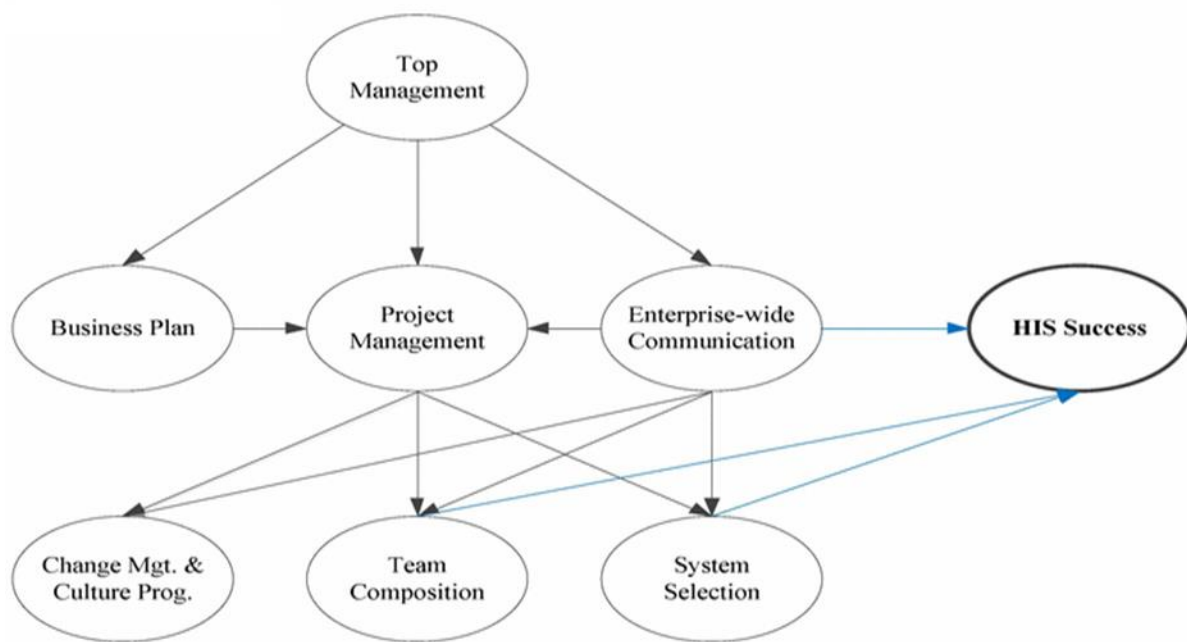


Figure 2.7: Hospital Information System Key Success Factors (Abdullah, 2012)

2.5 The D&M IS success model

The D&M IS Success model is a very well established model of assessment of IS implementations' success. It addresses the independent variables that affect IS success as a dependable variable. The research adoption of this model has been outstanding, and has exceeded the expectations of the authors themselves as per their 2003 review of the model (Delone, 2003). A citation search by the authors, in the summer of 2002, yielded 285 refereed papers in journals and proceedings that have referenced the D&M model during the period 1993 to mid-2002. Many of these articles positioned the measurement or the development of their dependent variable(s) within the context of the D&M IS Success

framework (Delone, 2003). Consequently, the model became a common framework for reporting and comparing research work involving IS success or effectiveness. In a recent search, conducted in July 2014, the number of journals and publications that cited the D&M updated model reached 4499 publications.

After conducting one of the most comprehensive examinations of the literature of IS success, Delone and McLean concluded that there cannot be one measure of success. Rather, it is clear that there are many. Nevertheless, their rigorous study of those measures enabled their categorisation into six major groups as per Figure 2.8, below. The interaction and interdependency among those categories form the model. Researchers can get a better understanding of what constitutes IS success by studying the interaction between those categories, and the interaction between the components within each category.

After more than ten years of publishing their model, they published an updated version, which makes it more contemporary and suitable for IS success assessment. Before briefly addressing the update, it is useful to summarise the primary conclusions of the original article (DeLone & McLean, 1992) as it was listed in their 2003 article:

1. The multidimensional and interdependent nature of IS success requires careful attention to the definition and measurement of each aspect of this dependent variable. It is important to measure the possible interactions among the success dimensions in order to isolate the effect of various independent variables with one or more of these dependent success dimensions.
2. Selection of success dimensions and measures should be contingent on the objectives and context of the empirical investigation; but, where possible, tested and proven measures should be used.
3. Despite the multidimensional and contingent nature of IS success, an attempt should be made to significantly reduce the number of different measures used to measure IS success so that research results can be compared and findings validated.
4. More field study research should investigate and incorporate organisational impact measures.
5. This success model clearly needs further development and validation before it could

serve as a basis for the selection of appropriate IS measures (p. 88).

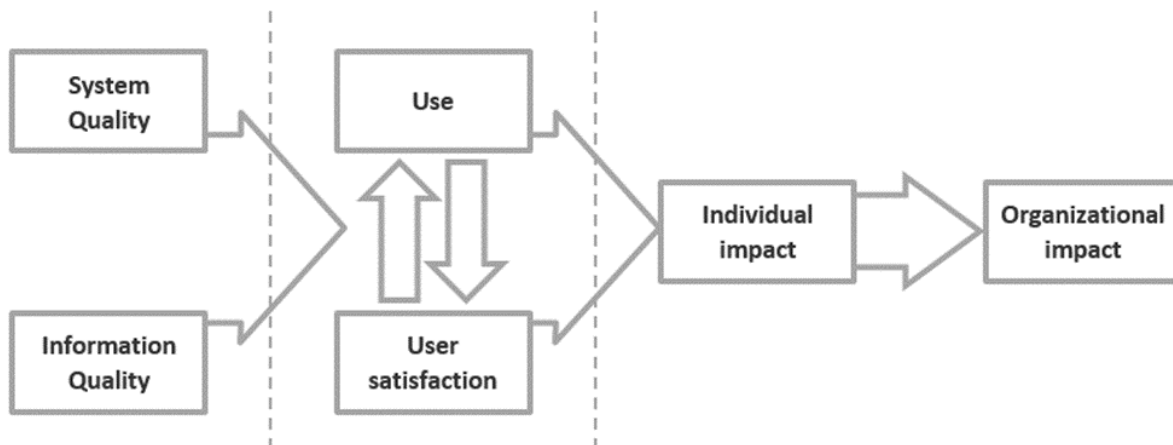


Figure 2.8: Delone & Mclean (1992), D&M original IS Success Model

Based on the adoption of the D&M model by many researchers, and the changes in information systems management to become a strategic function of organisation, the authors updated their original D&M model. The updated model, shown in Figure 2.9 below, seems to be more suitable for assessing a relatively modern variation of IS like eHealth. The introduction of Service Quality is aligned with the contemporary role of IS as a service or a business enabler. User satisfaction seems to be a more precise measure, as using a system and using the system effectively are two different variables. Similarly, the “use” and “user” satisfaction can cause net benefits if that use was planned to address one or more of the system’s objectives.

The updated D&M IS Success Model includes arrows to represent suggested associations along success dimensions in a process sense, but does not show positive or negative affects for those associations in a causal sense. The nature of these causal associations should be hypothesised for each particular study defining the context, which is something this research intended to do. Thus, if a system is of high quality, it would be associated with more use, more user satisfaction, and positive net benefits. The projected associations would then all be positive. In another context, more use of poor quality systems would be associated with more dissatisfaction and negative net benefits. The projected associations would then be negative.

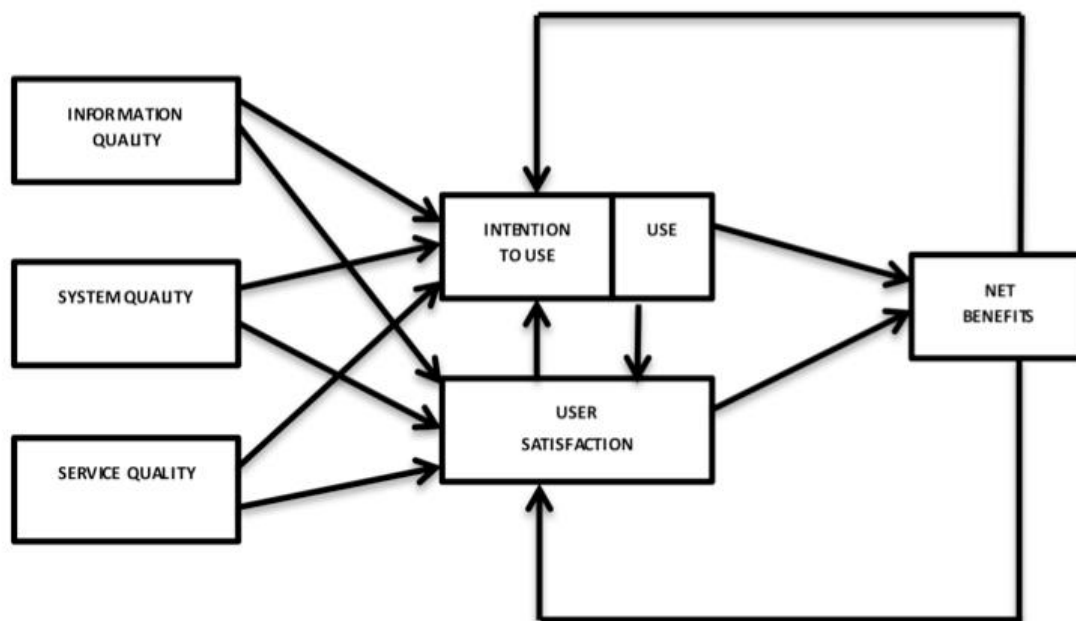


Figure 2.9: D&M Updated IS Success Model (Delone, 2003)

2.6 Knowledge gaps identified

This section will start with a critical view of the quality of the sources studied and their adopted methodologies, then it will move to the content of those studies in an attempt to identify potential gaps in the literature.

By observing the different categories of studies around eHealth, identified above, it can be noticed that the majority encompasses defining eHealth and evaluating its value. Most of those articles relied on scanning existing literature to determine themes and conclusions. Those studies were relatively high quality and they used robust research methodologies to analyse available literature and draw conclusions. Those methodologies included systematic searches of most relevant databases, in addition to the analytical effort undertaken to test the relevance and eligibility for inclusion in identified categories. The resulting studies were well-defined, well-structured reports on available literature and resulted conclusions. Yet, those studies seemed to have limited value or impact in practice.

When it comes to the content, the literature search has identified the main themes studied above. If we take a look at those themes, we can quickly realise that a large part of

the available literature was about defining eHealth and evaluating its value as above, in addition to other descriptive categories identified in the literature table. Such efforts, although were very helpful in establishing eHealth as a field and as base for further practical studies, remained theoretical without much practical value in developing the eHealth field and its future implementations.

Taking a general view of the eHealth literature, it does not seem to be as developed as the literature in other fields, even within IS. Some of the theories in eHealth are middle level in development, and the majority is in its infancy. In a similar manner, the search has identified some empirical work in the eHealth field but there is still some doubt over what to use in practice. Such observation is especially apparent in the case of eHealth implementations. Murray et al. explained:

Although there is a considerable body of work on factors promoting successful implementation in healthcare, implementation research within healthcare has been described as a 'relatively young science'. This is reflected in vigorous debates about how to understand implementation processes and about the theoretical tools that can be used to do this. These offer us generalisable frameworks that can apply across differing settings and individuals; the opportunity for incremental accumulation of knowledge; and an explicit framework for analysis. (2011, p. 12)

Previously, this gap was identified by Mair et al. (2007). They described it clearly when they noted:

Our work has demonstrated that the evidence base in the area of e-Health implementation research is unexpectedly weak. Barriers and facilitators to e-Health implementation have been identified but their relative importance remains uncertain. For example, it is unclear whether lack of engagement or champions is outweighed by the presence of adequate funding and congruent local and national policies or vice versa. There is therefore a need for studies that examine the implementation process in a much more detailed and thorough manner. (p. 140)

Therefore, based on the above, to bridge the gap between theory and practice, richer theories need to be developed and frameworks applied to understand

implementation success at a more granular level. Also, existing frameworks need to be enhanced and adopted to eHealth to enrich the currently modest body of knowledge available around eHealth implementation success. To target those objectives, this research will be deductive testing existing theory through a case study to establish organisational learning as has been done by other researchers. A major advantage will be to build confidence with practitioners, by presenting evidence based practice. One way to take it a step further and to make it more valuable for practical use is to test an eHealth implementation against one of the established IS success frameworks identified above. By conducting such a test, we can draw conclusions about the suitability of the established framework within an eHealth setting, and any recommendations to improve it.

Among the identified frameworks, almost all could potentially be the one to test in this research. As per Table 2.2, above, each has its relevance to this research. However, the D&M model stood out as being well established, and can potentially be tested in an eHealth environment generating value for practitioners. This test can contribute clear insight into success and its definition for an eHealth implementation.

CHAPTER 3. METHODOLOGY

3.1 Introduction

The previous chapter described the underlying literature and theoretical frameworks for eHealth and its implementations. This chapter presents the methods used in the research study. There is no universal standard against which a research methodology can be judged, rather it must be evaluated in terms of its ability to produce the type of results being sought (Mitroff & Kilmann, 1978).

The research design ponders the on-going debate in the IS research as a field between the positivist approach, typified by quantitative, scientific methods, and the interpretivist approach, which depends on qualitative methods such as interviews and case studies. Other approaches, such as critical realism, are also discussed and considered as a philosophical foundation for this research. The research study outlined in this thesis employs mixed methods, relying primarily on the use of qualitative interviews, and two case studies, which are supplemented by a quantitative survey. An exploratory pilot case study and an explanatory case study provide the qualitative foundation for the research. The survey was conducted through cooperation between the researcher and Golden Jubilee National Hospital (GJNH). The survey was conducted through the infrastructure of Manchester University, and its survey software, so the results were collected and analysed independently.

This chapter is organised as follows. As a first step, the ontological and epistemological perspectives for IS research, and subsequently eHealth, are discussed to establish the study's philosophical bases. This includes a presentation of the perspectives of positivism, interpretivism, and critical realism. In the second part, alternative research methodologies and the rationale for choosing the selected research design are clarified. The third section discusses the research methodology with an explanation of how mixed research methods were applied. The fourth segment addresses research design, which is followed by a description of the data collection process and activities. Finally, the last part of the chapter includes a critical view of the research approach.

3.2 Ontological and epistemological bases of eHealth critical success factors

This section presents the philosophical and methodological nature of this thesis. It is believed that solid ontological and epistemological bases foster the development of a field of research (Micheli, 2009). In order to produce valuable results, it is important to understand the philosophical bases of research. The purpose of this research is to create knowledge, specifically around eHealth. Accordingly, the ontological perspective of how we understand the world, and the epistemological perspective of how we know and understand information, must both be comprehended, and preferences acknowledged. It is important to scrutinise the philosophical orientation of this research before it starts. As such, the researcher understands his view of the world to reveal how we know what we know, and how this research will create useful knowledge around eHealth.

Boyne et al. (2006) stress that a theoretical foundation is especially important in management research as it enables the generations of clear testable hypotheses paving the way for promising lines of future research. Similarly, Talbot believes that evidence-based management can only progress if real efforts are made to address 'consilience', that is internal consistency of theory, both within and between disciplines, that would allow cumulative instead of dispersive progress in knowledge. Talbot calls for "...explicit theorising, including stating clearly the ontological and epistemological bases of the research and not dodging the issue" (as cited in Walshe et al., 2010, p. 286).

Those bases are split into ontological groupings to help understand the world and the phenomena under study in addition to epistemological bases to understand how we build our view and interpretations of the phenomena. Both aspects lead to creating knowledge about the subject of the research, which is the overall objective of the exploration. Before going into the study, we first need to address our understanding of those philosophical concepts to be aware of the paradigm we are conducting this research under, to think of how we create knowledge, to determine how the knowledge created might be useful in further research, and also to create value for potential users. In the context of Management Information Systems (MIS), Walsham (1995) explained that the purpose of the philosophical foundation is to critically test the underlying assumptions and theoretical constructs which build our understanding of MIS, and accordingly, its practice.

3.2.1 Ontology

When addressing ontology as a foundation of this research, it is addressed primarily from a philosophical perspective. To make it more relevant to this investigation, it is also approached from a business research perspective. While looking at the inquiry from an IS or eHealth perspective brings focus and enriches the research with an understanding of the ontological orientation within the research's field of study.

To take a social research perspective on ontology, it is beneficial to highlight the work of Bryman and Bell (2007) who related ontology to the nature of social entities. In a similar fashion to how Plato studied objects and whether they exist independently from the sensory activities, Bryman and Bell studied a key issue related to whether social entities have reality independent from social actors, or whether they are just the perceptions and actions of social actors (2007, p. 22). Two ontological orientations emerged from this differentiation: objectivism and constructionism.

Objectivism says that organisations and culture do exist regardless of the activities of social actors. It is also called realist ontology, as it asserts that reality exists independent from the observer, similar to Plato's true reality. Constructionism argues that organisations and cultures are a product of social actors' interaction, and are not constant but changing. Table 3.1 depicts objectivism and constructionism along with epistemological orientation in relation to qualitative and quantitative research methods.

Taking ontology one step further, this research investigated ontology in the field of IS research. According to Orlikowski and Baroudi, ontological beliefs:

... Have to do with the essence of the phenomena under investigation; this is, whether the empirical world is assumed to be objective and hence independent of humans or subjective and having existence only through the actions of humans in creating and recreating it. (1991, p. 7)

Accordingly, an objectivist view would state that social entities exist whether humans recognise or sense that entity or not. In contrast, a constructionist view would

assert that social entities would not exist without the participation of humans. If we apply those views to eHealth, an objectivist view would argue that eHealth is a concept that exists independent of the observations of individuals, while the constructionist view would say that eHealth only exists as a product of development and interactions of individuals and organisations.

3.2.2 Epistemology

In research, the ontological and epistemological aspects define the orientation of research whether qualitative or quantitative. Bryman and Bell (2007) use an epistemological and ontological orientation to define the differences between quantitative and qualitative research, as illustrated in the Table 3.1. Bryman and Bell (2007) suggest that quantitative research methods have a positivist epistemological orientation and an objectivist ontological view that the world or group of objects exists and waits to be explained through scientific discovery. This model is common in natural sciences research like physics, chemistry, and biology. In contrast, qualitative techniques often, but not exclusively, are characterised with an interpretivist epistemology and a constructionist ontological view. The qualitative approach is to produce theoretical concepts as an outcome of the research (Bryman & Bell, 2007).

Bryman and Bell (2007) map the differences between qualitative and quantitative research; they highlighted that such categorisation is useful and current, but is not universally accepted. Other views see that the distinction is “no longer useful or even simply false” (Layder & Layder, 1993 as cited in Bryman & Bell, 2007, p. 28). Yin went to the extent to claim “any contrast between quantitative and qualitative evidence does not distinguish the various research methods” (2009, p. 19).

Table 3.1: Source: Research strategies (Bryman & Bell, 2007, p. 28)

	Quantitative	Qualitative
Principal orientation to the role of theory in relation to research	Deductive; testing of theory	Inductive; generation of theory
Epistemological orientation	Positivism – natural science model	Interpretivism
Ontological orientation	Objectivism	Constructionism

The next sections will address specific orientations in epistemology to try to clarify them as potential bases of the thesis. Those sections will provide a basic explanation of positivism, interpretivism, and critical realism.

3.2.3 Positivism

The publication, “The Course in Positive Philosophy”, by the French philosopher Auguste Comte (1798-1857) is probably one of the main references in positivism as a philosophical orientation of research. In his publication, Comte defined three stages through which human knowledge passes. Those stages, according to him, are: theoretical or fictitious, metaphysical or abstract, and scientific or positive. In the positive stage, the mind is applied to studying the laws of the universe as, “reasoning and observation, duly combined, are the means of this knowledge” (Martineau, 1868) through a combination of observation and reasoning. He reduces knowledge to only what is based on observable facts. He clarifies by saying that “there can be no real knowledge but that which is based on observable facts” (Martineau, 1868).

Scientific research is the main manifestation of the positivist view. Its aim is to uncover the universal laws of cause and effect, and discover repeatable models through examination. Natural sciences benefited from the positivist approach in building a world that can be measured, built, changed, and managed (Hirschheim, 1985).

According to Denscombe (2002), positivism in the social sciences is the application of the natural science research model to the investigation and explanation of social phenomena and the social world. Under this view, a positivist expects that an objective social reality exists, as natural universal laws, and can be examined and explained through scientific experimentation. Orlikowski and Baroudi also addressed positivism and claimed: “positivist studies are premised on the existence of a priori fixed relationships within phenomena which are typically investigated with structured instrumentation. Such studies serve primarily to test theory, in an attempt to increase predictive understanding of the phenomena” (1991, p. 9). Positivist researchers in social sciences, as in natural sciences, do not interfere in the phenomena under study, rather they take the role of an observer of the phenomena, and try to discover its inherent rules, and explain its internal relations. Such a

unified view of the positivist approach to social research has resulted in possible weaknesses. Narrowing the view to natural explorations in social sciences including IS research, has consequently limited the universe of research. A dimension of the subject matter that social scientists examine, that natural sciences do not, is what the field of phenomenology calls the life world, which is the world of consciousness and humanly created meanings (Ngwenyama & Lee, 1997, p. 149).

Although social research can examine the measurable outcomes, or costs and benefits of eHealth, other aspects of eHealth like organisational relations and resistance of clinicians are harder to measure using a positivist approach. This can probably be best expressed as Hirschheim concluded on positivism and its success in the natural sciences: “its application in the social sciences has, however, been less than spectacular” (1985, p. 13).

3.2.4 Interpretivism

A strong starting point for this section can be with Denscombe’s view on interpretivism:

Social reality is something that is constructed and interpreted by people – rather than something that exists objectively ‘out there’ ... the social world does not have the tangible material qualities that allow it to be measured, touched, or observed in some literal way. Moreover, Interpretivists tend to focus their attention on the way people make sense of the world and how they create their social world through their actions and interpretations of the world. (2002, p. 18)

Accordingly, interpretivism is a denunciation of the positivist approach to the study of social phenomena. Similarly, interpretivism is also called anti-positivism or non-positivist. Interpretivists argue that the positivist approach is unsuited for social research as social phenomena are not ruled by the universal laws that govern the natural world. Different researchers like Walsham (1995), and Klein and Myers (1999) have claimed that the interpretive approach is important to understand the human and organisational aspects of information systems.

As their colleagues in social sciences, IS researchers have addressed the merits of

interpretivism over the last twenty-five years. Hirschheim identified Wilhelm Dilthey (1833-1911) as the founder of the anti-positivist movement, suggesting that life cannot be understood as a machine, but “needed to be viewed within the context of a ‘philosophy of life’” (1985). Orlikowski and Baroudi defined interpretive studies as those that “assume that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them” (1991, p. 5). In addition, interpretive studies have another aspect to them, which is the non-deterministic perspective where the intent of the research is to increase understanding of the social entity within the cultural and contextual situations, where the social entity under study was examined in its natural setting and from the perspective of the participants, and where the researchers did not enforce an outsiders’ a priori explanation.

Interpretivist investigation has been largely accepted in IS research and advocated for almost three decades. Galliers and Land (1987) made a distinctive claim that “the scientific paradigm is not the only, nor indeed always the most appropriate basis for our IS research” and that “it is more appropriate to extend the focus of study to include behavioural and organisational considerations ... to improve the effectiveness of IS implementations in organisations and to assess the impact on individuals or organisations”(901). Walsham (1995, p. 74) noted a “need for much more work from an interpretive stance in the future, since human interpretations concerning computer-based information systems are of central importance to the practice of IS and thus to the investigations carried out by IS researchers.” Walsham prefers “interpretive case studies which make a valuable contribution to both IS theory and practice”. While, Chen and Hirschheim confirm that in IS research, “alternative paradigms such as interpretivism have emerged in the field and have become more widely accepted” (2004, p. 198).

As appealing as it is within social sciences, interpretivism does have its weaknesses. A researcher’s subjective bias can be challenging to point out. Accordingly, the reliability of the research will be affected. The researcher’s background or experience can significantly affect his/ her explanation of phenomena or situations under an interpretivist paradigm. Hence, generalisation would become an issue, as the results of a studied instance cannot be easily generalised to the overall phenomena.

3.2.5 Critical realism

Arguably, Roy Bhaskar is the founder of the critical realist movement. He positions his philosophical aim with Critical Realism (CR) as “to resolve and explain an old question that dominates philosophical discussions on the social sciences ... to what extent can society be studied in the same way as nature?” (Bhaskar, 1979, p. 1). CR supposes that a reality exists on its own awaiting to be discovered irrespective of individuals’ awareness of it. While the positivist paradigm holds that the scientific approach can be used to objectively discover reality, as summarised above, a critical realist accepts the issues with our capacity to know or quantify reality with conviction. As stated earlier, Bryman and Bell (2007) clarified the realists’ belief of a reality that is independent from our description of it. Mutch (1999, p. 329) defines CR as a realist ontology that suggests the existence of elements of the social world, which exist regardless of our current state of awareness of them. At the same time, CR accepts that we know the world through language; however, language does not define all elements of the world. In this sense, critical realists assume that there is a reality, but that reality is difficult to understand, and we will always be postulating the description of the ‘real’ (Easton, 2010). Critical realists support multiple research methods and techniques that can then be triangulated to balance the potential errors that will be introduced by each approach independently. As each technique has its own weaknesses and issues, using various measures provides different viewpoints of the underlying reality.

CR has become widely utilised with IS research. Mingers (2004) advocates the appropriateness of CR as a philosophy for IS, and related IS research, but he clarifies that realists assert that the world would exist independent from humans’ existence. For positivists, that which cannot be sensed cannot *be*. Accordingly, for positivists, only that which can be perceived can exist. However, for critical realists, having a causal effect on the world is enough to infer existence, irrespective of perceptibility. CR is also unique as it addresses both natural and social sciences and thus includes the main areas of IS. Although it highlights the weaknesses of positivism and interpretivism, CR still acknowledges the benefit of the research methods from these paradigms (Mingers, 2004).

CR could become an ideal paradigm to approach complex phenomena, such as those usually related to information systems, because it allows theorists and researchers to

construct more detailed explanations of a specified set of phenomena or incidents without having to use methods more suited for the natural sciences. As Dobson puts it, “critical realism is a relatively new philosophy that may provide a response to the crisis of positivism” (2001, p. 201).

When it comes to research methods, CR can add value to case study research. This was highlighted by Easton (2010) when he noted that a case study is a suitable method for inter organisational research. However, it does not have a strong philosophical base, meaning ontological and epistemological foundations. The validity of case studies cannot be defended under positivism, since such research is almost always with small samples. Accordingly, CR is a suitable alternative for case research when it encompasses a thoughtful, in-depth study with the goal of understanding why things are the way they are. In such cases, the most important research question is about what caused those events to happen. Thus, adopting CR, this research aims to understand what success is in eHealth implementations, and what are the factors and inter-organisational conditions that affect that success. Basically, it aims to understand why things are the way they are when it comes to eHealth implementations.

This research about eHealth implementations embraces a realist approach, which relates to Bryman and Bell’s statement, “there is a reality that is separate from our descriptions of it” (2007, p. 18). Irrespective of this study, eHealth implementations would be carried out by healthcare organisations like the ones that took place at IB Salut, and GJNH described later in the thesis. Users and stakeholders perceive some of those implementations as successful. Suitably, success in eHealth implementations, as per the Bryman and Bell (2007) definition, is a social phenomenon that is created by means that are real. Yet, those means are not directly accessible to observation and are visible only through their effects.

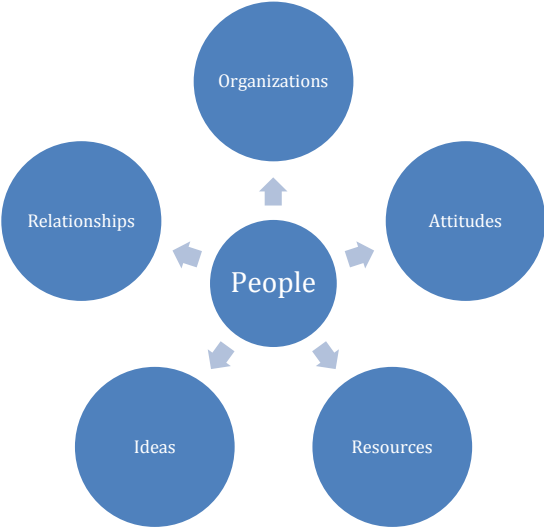
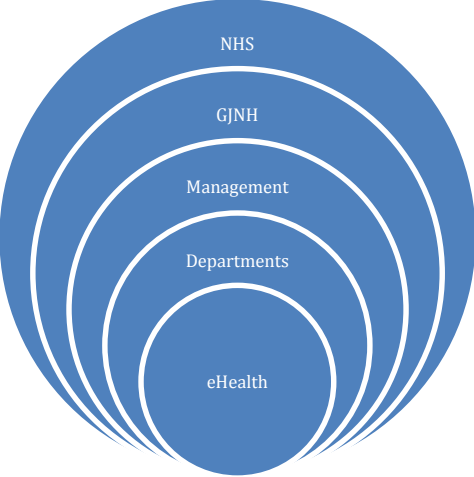
The reality of the phenomenon is established by the reoccurrence of eHealth implementations in different independent organisations, and the shared perception of some of those implementations being successful. The phenomenon of eHealth implementation success is visible through its effects on different areas, of which some are described by the

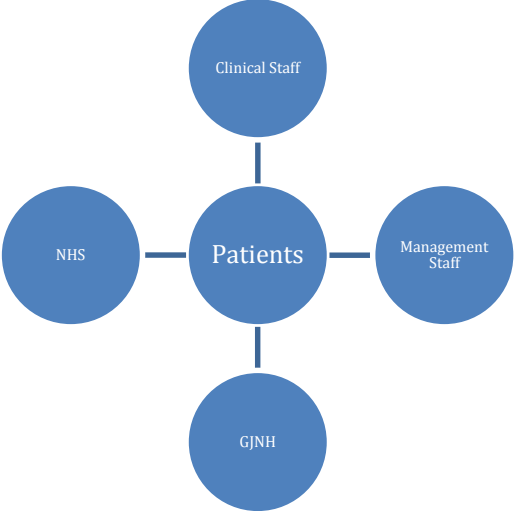

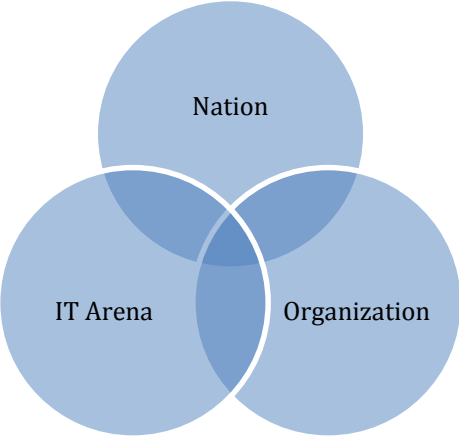
D&M IS implementation success model explained earlier.

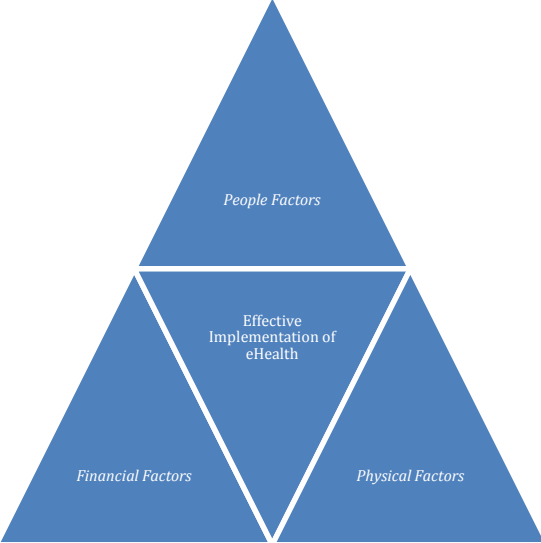
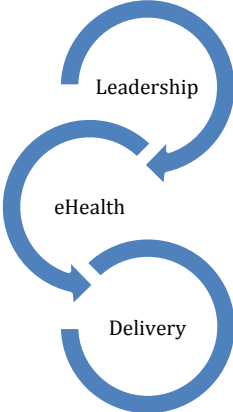
The CR philosophy is similar to positivism in the way it supposes that “there is a reality which is independent of human knowledge” (Morton, 2006, p. 1). This high level description is further explained by Mingers (2004) who states that critical realism seeks to get underneath the surface to comprehend and explain why things are the way they are, and to hypothesise the constructions and mechanisms that identity observable events. Consequently, CR acknowledges the existence of a variety of objects of knowledge such as material, conceptual, social, and psychological. Each of those objects requires different research methods to come to comprehend them.

This study plans to understand success of eHealth implementations within healthcare organisations. With such a goal, it proposes that this subject is a complex social phenomenon that occurs in healthcare organisations, and is affected by different stakeholders and factors both internal and external to the organisation. Such an understanding can be related to Easton’s recommendation: “A critical realist case approach is particularly well suited to relatively clearly bounded but complex phenomena such as organisations and inter- organisational relationships” (Easton, 2010). Similarly, Morton states that: “CR is particularly helpful for IS research where natural science methods (e.g. controlled experiments) are difficult to apply such as in organisational settings, involving IS, where complex interactions occur and outcomes are not predictable” (2006, p. 1). Accordingly, this research suggests that CR is an appropriate philosophical stance under the proposition that success of eHealth implementations is a complex interaction occurring in an organisational setting. Consequently, in the rest of this chapter CR will be the stance, acknowledging that the reality success in eHealth implementations exists independently of any of the studies and analyses conducted throughout this research. In taking this position, we acknowledge that the findings do exist independently, and the same results presented in this thesis could come from different organisations by different researchers. The table 3.2 below is an illustration of how the different aspects of CR outlined by Easton can be applied to this research.

Table 3.2: Key components of Critical Realism philosophy, adopted from Easton 2010, pp. 120-123

Critical Realism Component	Description	Components Expected
Objects / Entities	Basic theoretical building blocks, such as organisations, people, relationships, attitudes, resources, MIS, inventions, ideas	
Causal powers and liabilities	Causal power is the ability of an entity to make things happen; a liability is a susceptibility to the action of other entities	

<p>Events</p>	<p>Outcomes that the critical realist investigates (i.e. the external and visible behaviours of people, systems and things as they occur, or as they have happened)</p>	
<p>Structure of entities</p>	<p>A set of internally related objects or practices; for example an organisation may be considered to comprise a series of other entities such as the departments, people, processes and resources</p>	
<p>Necessary relations</p>	<p>Relations that derive directly from the nature of the bodies involved</p>	<p>An interplay across the clinical, management, and technical staff.</p>
<p>Context</p>	<p>Relevant circumstances</p>	

<p>Structure of causal explanation</p>	<p>A formal statement of the critical realist structure of explanation using objects, structures, causal powers and liabilities. A causal explanation is one that identifies entities mechanisms that connect them and combined to cause events to occur</p>	
<p>Mechanisms</p>	<p>Ways in which structured entities by means of their powers and liabilities act and cause particular events</p>	
<p>Epistemology</p>	<p>Meaning has to be understood and could not be measured or counted; observation is fallible further data must be collected distinguish among alternative explanations</p>	<p>Strength</p> <ul style="list-style-type: none"> •Triangulation of data sources and collection tools, and research methodologies, leads to improved reliability <p>Weaknesses</p> <ul style="list-style-type: none"> •The findings of a case-study research method are not necessarily generalizable •The cross-sectional research design cannot confirm casual relationships

<p>Research Process</p>	<p>Retroduction, which explains events by postulating mechanisms that are capable of producing them; what produces change. Retroduction involves asking “what must be true in order to make this event possible?”</p>	<pre> graph TD A[Confirm relevance of D&M model] --> B[Assess success of eHealth implementation] B --> C[Identify all relevant factors, and potential interrelationships across them] C --> D[Adapt existing model] D --> E[Quantitatively measure the effect of each factor] E --> F[Generate a holistic provisional framework to effectively guide the implementation of eHealth] </pre>
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In relationship to this project, the Easton’s framework uncovers several key elements, associated with the objects component, of which the most prominent one is; people, which, in principle, constitutes the core of the project. The people element, as the core of a diverging radial, can be related to the following other variables; organizations, attitudes, resources, ideas, and relationships. The casual powers and liabilities component sheds light on an interesting interplay between various entities. The eHealth lies at the core of this interplay, which is represented in the form of concentric circles. The eHealth is engulfed by a level representing the various departments within the organization. The functions of those departments are foreseen by the management within GJNH, which is one of the prominent national hospitals within the Scottish NHS. As for the events component, the aim to provide patient-centred care guides the overall mission of this project, and hence, constitutes the core of a radial representation. Accordingly, from the CR perspective, this study is expected to result in factors pertaining to the patients, in addition to ones related to the clinical and management staff, GJNH, and the NHS. The importance of the means by which people and teams are managed, within GJNH, is evident when viewing the trajectory of the research study from Easton’s CR framework, in general, and the structure of entities component, in specific. Hence, people and teams management

constitutes the sun of the solar system of the following interlinked variables; organizational structure, leadership, change management, and organizational culture. As for the relationships necessary for the viability of the research project, the CR framework sheds light on a fundamental, continuously changing interplay across the clinical, management, and technical staff.

In relation to the context, of the research study, the CR perspective exposes several levels of circumstantial variables, which can be represented by a Venn diagram of three circles of variables; IT arena, national, and organizational. The overlap of the circles reflects upon the stance where the overlap (co-existence) of those expected myriad of circumstantial events will enable the happening of the project under study. The ultimate goal of the study is to assess the effective implementation of eHealth and determine corresponding factors. Taking the target into consideration, the CR structure of causal explanation framework uncovers the potential existence of independent variables that could be related to people, physical infrastructure, and financing. The mechanisms component highlights the potential means by which the leadership causes events at the level of the eHealth which in turn affect the implementation of the project. From the perspective of epistemology, having defined the research methodology and design, the results of the study is expected to be reliable given the rigorousness of the overarching research approach. However, given the cross-sectional, case-study design; the results, whatever they turn out to be, cannot be assumed to be generalizable, and the casual relationship between any of the associations cannot be confirmed. Finally, the research process, according to the CR framework, is expected to unfolding according to the following basic outline; confirm relevance of D&M model, assess success of eHealth implementation, identify all relevant factors, and potential interrelationships across them, adapt existing model, quantitatively measure the effect of each factor, and generate a holistic provisional framework to effectively guide the implementation of eHealth.

3.3 Rationale for choice of research methods

This section is meant to present the possible choices for research methods that could be used in this research, and to assess the research methods chosen. Orlikowski and Baroudi (1991) addressed that stage in conducting research and they believe it is required

regardless of the orientation of the research. In this regard, they state “self-reflection about research perspectives applies to all researchers, whatever perspective they adopt, whether interpretive, critical, or positivist”.

In IS research, different studies were conducted around the research approaches and methodologies suitable for IS studies. Some of the most known work around that area is the research by Galliers (1992), Orlikowski and Baroudi (1991), and Galliers and Land (1987). They defined the constructs of IS research choices of methods, and the rationale of the methods’ potential suitability to IS research. Those choices are summarised in Table 3.3, adopted from Galliers and Land (1987).

Table 3.3: Approaches for IS research adopted from Galliers and Land (1987)

Research approach	Applicable?	Mode
Theorem proof	No	Traditional Observation
Laboratory experiment	No	Traditional Observation
Field experiment	Possibly	Traditional Observation
Survey	Yes	Traditional Observation
Forecasting	Yes	Traditional Observation
Simulation and game or role playing	Possibly	Interpretation
Subjective argumentation	Yes	Interpretation
Descriptive / Interpretive	Yes	Interpretation
Action Research	Possibly	Interpretation

As listed in the table above, different approaches can be used in IS research, while others, like theorem proof and laboratory experiment, would not be suitable for IS research in organisations. Some of the options are possible, like field experiment and simulation, but have low suitability for the research field. Two of the approaches that could prove to be appropriate, however, that were not used in this research, are the forecasting approach and subjective argumentation. Forecasting was declined because the research would occur over a timeline that is shorter than the scope of a forecast, where the success definitions of eHealth implementation would be forecast into the future and results would be observed over time. As subjective argumentation is based more on subjective opinions and less on observation, it would not be suitable for a DBA thesis, while it could be suitable for management consultancy reports. Given the critical realist orientation of this research,

action research would have been a relevant approach. One part of an action research approach was unattainable, though, which would be taking part in the application of the eHealth initiative or at least being engaged with the implementation team during and after the introduction of the eHealth portal. However, it was not feasible to apply the findings of the environment and observe changes in the outcomes, due to constraints in time and scope.

Over the actual period of research, this investigation considered two approaches that proved inappropriate; participant observation and document review. Participant observation was beyond the scope of this research because it required a longer time commitment than that intended for the research, in addition to organisational approvals. eHealth success, as a complex phenomenon, is not easily observed by taking a role in the implementation process. There are many aspects to eHealth implementation success that affect different members in the organisation, in addition to technical and financial factors.

Document review has occurred in this research, but not as a main approach. Many of the documents related to eHealth are restricted as they might contain patient information, or critical organisational performance data. However, the hospital did share documents related to their eHealth strategy, functional designs of systems, review meetings, and systems' evaluations.

Combining multiple methods serves in achieving a certain level of triangulation. Miles and Huberman addressed triangulation and identified different types of it by: data source, method, researcher, and data type (qualitative or quantitative) (1994, p. 267). In this sense, using multiple methods allows for a better understanding of the phenomenon under study, with each method shedding light from a different angle. With this understanding, qualitative and quantitative methods do not replace each other. Rather, they complement each other because each method provides a unique perspective on eHealth implementation success.

The initial pilot case study allowed some main themes to emerge, which suggested that leadership and clinical involvement are important subjects in the eHealth

implementation success. Those results, combined with findings from the literature search, led to building the overriding inquiries of the main case study. As the main case study was conducted, and results analysed, some of original themes became more specific, and some new themes materialised, as well. For example, within leadership as a factor, a more specific feature emerged, which is the role of change champions. Training delivery preferences was a new theme, as well. Eventually, to provide a certain level of triangulation, the quantitative survey was conducted to validate the relative importance of the themes that emerged from the qualitative research. This model of mixing qualitative fieldwork, interviews, and case studies with quantitative questionnaires, was highlighted by Miles and Huberman (1994) as a way of linking the two research methodologies into a mixed method approach.

3.3.1 Using critical realism to examine eHealth success

Critical realism as a philosophy is arguably at the core of this research because of its suitability to the research conditions and background. This research accepts that eHealth implementation success exists in objective reality. Yet, acknowledges that eHealth implementation success is complex and not easily observed because it is manifested in the perception of users, stakeholders, and the actual measured outcomes that can be attributed to the eHealth implementation at a given healthcare provider. Each of these areas contains multiple persons and measures, at different organisational levels, which are involved in the assessment and measurement of eHealth implementation success. Or as Greenhalgh et al. put it, an implementation of eHealth is not identified as “a blueprint and implementation plan for a state-of-the-art technical system but as a series of overlapping, conflicting, and mutually misunderstood language games that combine to produce a situation of ambiguity, paradox, incompleteness, and confusion” (2011, p. 534). Multiple research methods, quantitative and qualitative, need to be used to triangulate and understand the success of eHealth implementations.

Maintaining a CR stance, this research used both qualitative (interviews and case study) and quantitative (surveys and content analysis) methods to triangulate and understand the factors affecting eHealth implementation success. Since CR acknowledges the existence of multiple objects of knowledge (material, conceptual, social, and

psychological), it understands that each of these objects requires different research methods to come to comprehend them. This means that to gain knowledge, a variety of research methods needs to be applied, knowing that each of them will have a limitation or bias, which must be understood, in advance (Miles & Huberman, 1994).

Despite the fact that the research topic of success in eHealth implementations is relatively new, there is a fair amount of academic research on this topic, but no explicit theoretical model that is widely used and adopted. Since the commencement of this research in 2009, interest in this topic has grown. There have been a number of national initiatives and projects, which shed light on this topic, including the meaningful use initiative in the US, which was part of the Obama Care program in which a significant amount of money was spent on eHealth projects. Such exposure focused the attention on factors that make those implementations successful (Greenhalgh et al., 2011). Overall, the research was conducted with explanatory orientation aiming to understand the background, factors, and conditions that contribute to or affect the success in eHealth implementations.

3.4 Research approach

This section is designed to clarify the research approach and explains the justification for using mixed methods in this research. Afterward, it describes the methods used in this enquiry, including the: case study, qualitative interview, survey, content analysis, and framework analysis.

3.4.1 Mixed methods

A respectable introduction to the mixed methods approach is Denscombe's view of what drives the research design, which "tends to be the research question, not the purity of an ontological or epistemological stance about which the social world is like and the fundamental principles by which we can come to understand it" (2002, p. 23). This view differs from the classical divide between the natural science quantitative research orientation and the social science qualitative research orientation, split by the interpretivist and positivist epistemological stances. Greene described a combined methodology as a way of thinking and perceiving the world:

A mixed methods way of thinking is an orientation toward social inquiry that actively invites us to participate in dialogue about multiple ways of seeing and hearing, multiple ways of making sense of the social world, and multiple standpoints on what is important, and to be valued and cherished. A mixed methods way of thinking rests on assumptions that there are multiple legitimate approaches to social inquiry and that any given approach to social inquiry is inevitably partial. Better understanding of the multifaceted and complex character of social phenomena can be obtained from the use of multiple approaches and ways of knowing. (2008, p. 20)

In IS research, the subject of mixed methods has been contested. Much of this contention is about balancing between quantitative and qualitative research methods. This debate is about research diversity identified by Chen and Hirschheim as “the issues of research diversity and methodological pluralism” (2004, p. 189). As part of this debate, Orlikowski and Baroudi suggest that: “a single research perspective for studying information systems phenomena is unnecessarily restrictive” and “much can be gained if a plurality of research perspectives is effectively employed to investigate information systems phenomena” (1991, p. 1). Similarly, in a valuation of the diversity of IS research methods Robey contends that “diversity in IS research expands the foundation upon which knowledge claims in the field are based” (1996, p. 403). Remenyi and Williams assessed both positives and negatives of qualitative and quantitative IS research and concluded that “both approaches to research are necessary and each depends on the other” and “that multiple approaches to a research problem may lead to very satisfactory results” (1996, p. 145). This approach may be vital to answer the thought-provoking research questions of the IS discipline.

Bryman and Bell addressed the mixed methods approach to research as integration between qualitative and quantitative research: “mixed methods research is used as a simple shorthand to stand for research that integrates qualitative and quantitative research within a single project” (2007, p. 642). They added that “the amount of combined research has been increasing since the early 1980s and in business and management research is particularly popular” (2007, p. 642). Yin suggested that mixed methods provide stronger evidence: “mixed methods research can permit investigators to address more complicated

research questions, and collect a richer and stronger array of evidence than can be accomplished by any single method alone” (2009, p. 63).

Miles and Huberman (1994) highlighted the benefits of mixing qualitative and quantitative research designs. Those benefits include confirmation through triangulation, elaboration and providing richer detail, and initiation of new lines of thinking and fresh insight. Petter and Gallivan agree, confirming: “to achieve a better understanding of the effect of Information Systems in organisations, researchers should invoke mixed method research in which both quantitative and qualitative methods are used” (2004, p. 1). They add, “the advantages of examining a problem using both qualitative and quantitative approaches has been touted for 25 years,” and then continue, “thoughtful use of mixed methods can capitalise on the strengths and defuse the weaknesses of the methods ... Divergent results from each method allow the researcher to develop more complex and potentially novel explanations of a phenomenon” (2004, p. 1). When it comes to the purposes of using mixed methods, Petter and Gallivan suggest that those include triangulation, complementarity, development, expansion, and initiation. Table 3.4 provides an explanation for each motive and describes their relevance to this research.

Table 3.4: Motivation for mixed methods research (Petter & Gallivan, 2004, pp. 5-6)

Motivation	Description	Does it apply? Why?
Triangulation	“seeks to improve the accuracy of results through the analysis and collection of different types of data”	Yes. Qualitative and quantitative research shared on high percentage of the results, achieving triangulation for those results.
Complementarity	“to provide additional richness and detail to better understand a phenomenon”	Yes. Surveys, interviews, and case studies provide multiple viewpoints that augment the analysis.
Development	“to help in the development of the primary study”	Yes. The initial case study helped to focus the research, for example identifying clinical involvement as one of the main factors of eHealth success.
Initiation	“uncover paradox and contradiction for a new understanding of the problem”	Yes. The paradox benefits of eHealth verses its implementation success.
Expansion	“expand the scope and breadth of the problem by studying multiple phenomena; this is motivated by a desire to provide a more comprehensive solution or understanding of a problem”	Yes. The case study highlighted the main success themes, and the survey clarified the importance of each.

Taking a step back and looking at mixed methods with reference to epistemology, this “approach to social inquiry distinctively offers deep and potentially inspirational and

catalytic opportunities to meaningfully engage with the differences that matter in today's troubled world, seeking not so much convergence and consensus as opportunities for respectful listening and understanding" (Greene, 2008, p. 20). Such a view seems to reflect the case for eHealth:

Differences in underlying philosophical position may lead to opposing quality criteria for 'robust' evaluations. Some eHealth initiatives will lend themselves to scientific evaluation based mainly or even entirely on positivist assumptions, but others, particularly those that are large-scale, complex, politically driven, and differently framed by different stakeholders, may require evaluators to reject these assumptions and apply alternative criteria for rigour. The precise balance between 'scientific' and 'alternative' approaches will depend on the nature and context of the program and probably cannot be stipulated in advance. (Greenhalgh & Russell, 2010, p.4)

However, the above does not come without any risks. There are different areas of caution that should be addressed when using mixed methods. Bryman and Bell commented on these concerns: "poorly conducted research will yield suspect findings no matter how many methods are employed." They go on to say "there is no point collecting more data simply on the basis that 'more is better'" (2007, p. 658). It is the value and benefit of using mixed methods that should be behind the decision of using mixed methods as a research approach.

3.4.2 Case study method

Part of the decision to use the case study method was influenced by the case study techniques introduced by Yin. Yin provides a definition of a case study: "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context especially when the boundaries between phenomenon and context are not clearly evident" (2009, p.4). In addition, Yin notes "case study inquiry copes with the technically distinctive situation... relies on multiple sources of evidence... to converge in a triangulating fashion". Yin clarified "the distinctive need for case studies arises out of the desire to understand complex social phenomena" (2009, p. 18). The case study method is also influenced by Simons who defined it as:

An in depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program, or system in 'real life' context. It is research-based, inclusive of difference methods, and is evidence-led. The primary purpose is to generate an in-depth understanding of a specific topic (as in the thesis), programme, policy, institution, or system to generate knowledge, and/or inform policy development, professional practice and civil, or community action. (2009, p. 21)

As mentioned in the systematic literature review chapter, eHealth implementation in hospitals and across health systems is a contemporary phenomenon. In this context, this research proposes that an eHealth implementation is a complex social and business phenomenon lacking clearly defined boundaries. Greenhalgh et al. confirm:

eHealth initiatives often occur in a complex and fast-moving socio-political arena. The tasks of generating, authorising, and disseminating evidence on the success of these initiatives do not occur in a separate asocial and apolitical bubble. They are often produced by, and in turn feed back into, the political process of deciding priorities and allocating resources to pursue them. The dispassionate scientist pursuing universal truths may add less value to such a situation than the engaged scholar interpreting practice in context. (2010, p. 4)

As with Yin, Hartley confirms that case studies are suitable for emerging processes: "useful for exploring new or emerging processes or behaviours" (2004, p. 325). Hartley expanded on his perception of case studies in asserting they serve "an important function in generating hypothesis and building theory... the issues and theory may shift as the framework and concepts are repeatedly examined... the realities which conflict with expectations 'unfreeze' thinking and allow for the development of new lines of inquiry" (2004, p. 325). In accordance with this suggestion, the theories for this research were based on two initial theoretical frameworks, the D&M IS success model and the other project related factors summarised by Abdulla (2012). That theoretical base directed the semi-structured interviews and the exploratory case study. As the theoretical base for this study was examined through the interviews and the case study, it allowed for the 'unfreezing' of the initial perception about eHealth implementation success and provided new hypotheses,

which were subsequently tested through quantitative methods to derive a better understanding of their validity.

In addition to the suitability of the case study method for eHealth implementation success, as a relatively new field of research, case studies seem to be among the most appealing approaches. Eisenhardt and Graebner highlighted that view: “papers that build theory from cases are often regarded as the ‘most interesting’ research and are among the most highly cited pieces in Academy of Management Journals, with impact disproportionate to their numbers” (2007, p. 25). Similarly, Chen and Hirschheim examined 1,893 published IS articles, and found that some “case studies have gained substantial recognition (36%) ... and that IS researchers have become more interested in obtaining scientific knowledge in real world settings” (2004, p. 197).

As with other methods, case studies do have their weaknesses. In addition to building the justification for case studies, Yin clarified their challenges. According to Yin those challenges consist of the lack of rigor in case study research, limited basis for scientific generalisation, and the amount of time needed for case studies to be completed. He asserted his perspective by stating that “good case studies are still difficult to do” (2009, p. 16). Yin also listed three principles for judging the quality of research designs, including; construct validity, external validity (also called generalisation), and reliability, noting that all empirical social research should be judged according to those three standards (2009, p. 40). This research applied different practices to address the challenges of the case study research and also worked on addressing the three criteria listed by Yin. The remainder of this section includes a list of the criteria and how it was addressed in this research in addition to a description of how access for the case study was gained and maintained.

Construct Validity. The validity of the case study construct is established in different ways in this research, with various data sources. In the GJNH case study, different people from assorted departments were interviewed including people who were very positive about the eHealth implementation and others who were very critical. Many documents were studied including the national eHealth strategy, the GJNH local delivery plan, and implementation reports. Before that, the pilot case study at IB Salud was an initial source of

themes and concepts around eHealth implementation success, which were used in the GJNH case study. This research has attempted to provide different sources from its onset. The second area is establishing a chain of evidence similar to procedures in a forensic investigation, to paraphrase Yin (2009). Such a chain of evidence should demonstrate that no original evidence was lost. As a result, an external observer should be able to trace the steps from the original research questions, through the collection and analysis of case data, to the conclusions. In Chapter 4 of this thesis, the case study's details are demonstrated, including; the persons interviewed and their quotes, which generate the main themes. All interview transcripts and notes are available for review, as outlined in Table 3.5 below. The third area of achieving construct validity is by reviewing the draft of the case study by running it through key informants. A case study report was prepared in a business report format, and was run by the CIO and another executive at the national level. Their input was incorporated into the case study findings, and was used in determining the priorities of the qualitative research.

External Validity or Generalisation. Yin defined external validity as: “knowing whether a study's findings are generalisable beyond the immediate case study” (2009, p. 43). Yin proposes that case studies rely on analytical generalisation to extend a specific set of results to a broader theory. Generalisation is not granted and requires the theory to be tested in another similar situation. Yin argues that case studies differ from survey research because survey research relies on statistical generalisation, while case studies rely on analytic generalisation. In case studies, the researcher endeavours to generalise “a particular set of results to some broader theory” (2009, p. 43). Yin also argues that generalisation does not happen automatically and the theory must be tested by applying the findings to another similar case.

The main case study at GJNH supports the findings of the pilot case study at IB Salud. The case study at GJNH mainly aims to test the applicability of the D&M IS success model for an eHealth implementation.

Reliability. A case study is reliable when its findings can be consistently repeated by another researcher conducting the same case study. To defend reliability, the case study

procedure should be well defined and repeatable, and a case study database has to be produced. The procedure of the case study in this research is defined in details in Section 3.5.4. In addition, the database of the case study is listed in Table 3.5. Using the information provided in the case database, the case study analysis can be repeated. However, it has to be noted that people in organisations move on, or change their responsibilities, conditions, and other external and internal circumstances. The database is also useful as it makes the original data available to be tested by external researchers.

As mentioned earlier, and suggested by Yin, triangulation is another important technique to address reliability for case studies. Triangulation uses multiple sources of evidence to examine the same issue. Yin suggests that: “a major strength of case study data collection is the opportunity to use many different sources of evidence” (2009, p. 114), thereby demonstrating triangulation.

During the case studies, this research examined sample eHealth system reports of its performance and issues, in addition to other important documents like the Scotland eHealth strategy and its updates in terms of priorities and mandates to hospitals, as well as, the local delivery plan of GJNH. Sample communications were also viewed. The researcher conducted the interviews on site and spent time in the hospital beforehand to prepare for the case study and acquire the necessary approval. The time spent at the hospitals allowed the researcher to observe specific characteristics of those organisations, which provided additional context for the research. The effect of that context was apparent and provided a clear perspective on the subjects discussed in the interviews. For example, the communications around the eHealth system news, and how to use it was prevalent in the hallways and staff rooms. Through discussion with people around the hospital, it was clear who was more involved in the eHealth system implementation and operation, how users viewed it, who were the critics, and what was the general feel around eHealth. The combination of the above resources, in addition to the results of the qualitative survey, were tested to evaluate the extent to which triangulation can be achieved.

Table 3.5: Case database

Data Type	Information Source	Saved as
Interview Notes	Hand written during each interview, edited and annotated after interviews	Case notes binders; computer hard-drive
Recorded interviews	Digital recorder (iPhone)	MP3 on laptop, backed up on separate storage
Raw transcripts	Transcribed directly by the author	MS Word documents transcribed from MP3 recordings. Stored on laptop; backed up on a separate storage
Coded transcripts	Edited, colour coded transcripts revised from raw transcripts	MS Word documents. Stored on laptop; backed up on separate storage
Case description	Summary of case, findings and conclusions	MS Word documents. Stored on laptop; backed up on separate storage
Emails	Emails exchange between case members, the case sponsor and the researcher	Email documents stored on server and email software
Sample documents provided by GJNH	Documents provided by interviewees as email attachments and in hard- copy	MS Word documents. Stored on laptop; backed up on separate storage
Sample documents obtained	Documents downloaded from public websites	MS Word documents. Stored on laptop; backed up on separate storage

Securing and managing access. It takes a lot of effort to get the right sources of information, and to triangulate that information (Walsham, 1995). Hence, it is essential for the researcher to be persistent in seeking information, and to refuse to take ‘no’ for an answer. Fortunately, the Initial access to the case study was through previous relations of the author with the hospitals, which was based on previous work on joint eHealth initiatives. Walsham (1995) advises that providing feedback to the hosting organisation is important to show value and build credibility. The researcher worked closely with the case sponsor and case team, and provided feedback and updates at every step of the case study. Communication was continuous through face-to-face meetings, emails, and calls. The researcher committed to providing the host organisation with a full management report that can be used to improve eHealth implementations both within the organisation and regionally. In the beginning of 2014, the researcher provided the host organisation with a full business report that included the results of the case study and the qualitative research. The researcher also maintained access through consultation with the organisation, and participating in some of their committees. He kept access to the industry by being part of the industry organisations, and participating in eHealth conferences like Health Information Management Systems Society (HIMSS) events.

3.4.3 Qualitative interview method

The qualitative interview is at the heart of the case study research method, and both are applied in this research. Qualitative interviews use some pre-defined questions to provide a general structure to the interviews and define their flow. However, it should allow the participants to share their own views and add additional context to the dialogue, which may not be covered by the original set of questions. The predefined questions in this research are provided in Appendix A. Semi-structured interviews have been defined by Bryman and Bell explaining that the interviewer, although asking the same set of inquiries, “is able to vary the sequence of questions. ... Also, the interviewer usually has some latitude to ask further questions in response to what are seen as significant replies” (2007, p. 213).

During semi-structured interviews, the interviewer and interviewee interact face-to-face, which allows the interviewer to change the sequence and the content of the questions according to the answers and different perspectives brought up by the interviewee. Such a dynamic is particularly beneficial in pilot studies, and the initial part of the case study where more direction is needed, and the whole orientation of the research is defined. In addition, the person-to-person communication builds trust, which is important especially when the interviewees are sharing confidential or sensitive information. For example, the subject of politics related resistance to eHealth implementation, and how some departments were not as cooperative because they are concerned about their autonomy. It took a high level of trust for users to share such information, which is unlikely to happen if the interviews were remote.

Many of the described characteristics of qualitative interviews apply to this research as qualitative interviews normally have “a low degree of structure imposed by the interviewer; a preponderance of open questions; and a focus on specific situations and action sequences in the world of the interviewee, rather than abstractions and general opinions” (King, 2004, p. 11). Such an approach, which was used in this research, allows interviewees to focus the topics on areas of relevance to them and their organisations. The way those interviews were led assimilates King’s description: “The interviewee is seen as the participant in the research, actively shaping the course of the interview rather than passively responding to the interviewer’s pre-set questions” (2004, p. 11). King also suggests

that the interviewer should aim at validating the comments of the interviewees by reviewing organisational documents available directly, or obtained from websites and quantitative surveys.

Going into the specific field of IS research, Myers and Newman have analysed the qualitative interview in IS research and highlighted its importance, and some of its issues: “the qualitative interview is one of the most important data gathering tools in qualitative research, ... it has remained an unexamined craft in IS research ... with potential difficulties, pitfalls and problems” (2007, p. 2). Myers and Newman provided a list of seven guidelines for researchers to follow when conducting qualitative interviews. Their guidelines make a model, which is followed in this research and that is clarified in Table 3.6.

Table 3.6: Guidelines for qualitative research (Myers & Newman, 2007, pp. 17-22)

Guideline for qualitative research	Explanations	How it is applied to this research
1. Situate the researcher	Define the interviewer and interviewee: who are you, what is your role, background, experience, etc.	All interviews started with a formal introduction. Side notes were made about the environment, the atmosphere, and the surroundings during the interview.
2. Minimise social dissonance	“minimise anything that may lead the interviewee to feel uncomfortable”	Most interviews were conducted onsite; the interviewer accommodated the dress code, formal meeting process, introductions, and culturally sensitive.
3. Represent various views	“interview a variety of people within an organisation”	Different persons were interviewed, at different departments and different seniority levels; both persons who were supporters of the system and others who were not.
4. Every participant is an interpreter	“subjects are creative interpreters of their world as we are of theirs”	D&M model and other theoretical models were explained to the interviewees. The findings from the literature review and the pilot were also discussed.
5. Use mirroring in questions	Take interviewee’s words and phrases to construct a subsequent question or comment	This was done continuously during the interviews, many discussion that were not planned like user interfaces, training, and policy were not part of the original list of questions but emerged from interviewees’ comments.
6. Flexibility	“explore interesting lines of research, and look for surprises”	The research took many turns and got into a number of new angles as part of being flexible and listening to participants. This flexibility led to completely new part of the research, which is the “new or interesting themes”. The ideas that emerged were also run by interviewees for validity.
7. Confidentiality of disclosure	Keep records confidential and secure; provide feedback to check factual matters	All interviews were identified as confidential. All resulting materials have been saved as secure and confidential.

Interviews are not without disadvantages, especially when one considers the time and expense required to arrange, conduct, document, and validate the interviews. This research needed access to senior executives in large healthcare organisations. Executives,

like CEOs and CIOs, are busy individuals and have a lot of commitments and pressures on their schedules. Gaining access and building trust with those individuals was a significant challenge for this research. Another disadvantage of interviews was the ability to access and use confidential information. Even though eHealth projects, plans, and outcomes have a significant impact on hospitals' services and success, hospitals do not share confidential information easily. To get access to such information, a lot of time and personal interaction must be dedicated to gain the host organisation's confidence and trust.

3.4.4 Survey method

According to Bryman and Bell, survey questionnaires allow for quantifiable data to be collected and analysed with statistical methods. They identified the benefits of a questionnaire as being less costly and quicker to manage than other methods, such as interviews (2007). There are also disadvantages, such as the strain of asking additional or other kinds of questions, not knowing who has responded to the survey and to which questions, the difficulty of long surveys, and the inability to further investigate interesting responses (Bryman & Bell, 2007). The disadvantage of the survey, in this research project, was the difficulty in fully explaining questions for the respondents, and the risk that some of them may not have understood the questions correctly. Another challenge was getting access to the required email addresses of respondents, and the campaign to convince them to take the survey in order to get the number of responses required for the results to be statistically significant.

The survey in this research was designed based on the model provided by Bryman and Bell (2007, pp. 240-255). Thus, the design was aware of the need to be attractive and user friendly in order not to discourage potential respondents from answering. Demographic information about the respondents was collected in addition to a background about their roles, their experience in the organisation, and their experience using the system. Opinions and reactions towards the eHealth implementation were gathered in the middle of the survey using Likert scales. The last section of the survey asked about the interesting areas that surfaced from the interviews. Analysis of the survey data was initially performed with Excel computer software to capture general trends and to create charts. Then, the detailed analysis was performed using the statistical software program SPSS.

The motivation behind using the survey was the need to capture a large set of data from a wider sample of stakeholders. After the case study, the survey would test and qualify the findings of the qualitative research over a large sample size using statistical methods that allowed for an understanding of the level of certainty in the results. This test contributed to the achievement of triangulation, as discussed earlier.

3.4.5 Content analysis method

Content analysis was used in this research to analyse the websites of the hospitals investigated, in addition to the documents provided by them, and other documents, which were obtained from the public domain. Bryman and Bell defined the content analysis method as: "... an approach to the analysis of documents and text (which may be printed or visual) that seeks to quantify content in terms of predetermined categories in a systematic and replicable manner" (2007, p. 304). Neuendorf (2002) has built a nine-step content analysis flowchart, which was followed in the use of content analysis in this research. Table 3.7 below depicts those steps in relation to this research.

Table 3.7: Content analysis process (Neuendorf, 2002)

Step	Description	Applied to this research
1. Theory and rationale	What content to be analysed and why?	Analyse websites of GJNH, IB Salud and related websites, and provided and obtained documents
2. Conceptualisation	What variables will be used in the study and how do you define them conceptually?	Making references to the variables of the D&M IS implementation success model and other theoretical frameworks
3. Operationalise measures	What unit of data collection to be used	The variables mentioned above
4. Define coding schemes	Create code book with variable measures explained	Not applicable to this research
5. Sampling	Conduct a census of the content	GJNH and IB Salud websites, and GJNH documents all as in September 2013
6. Training and initial reliability	Train coders to reliably interpret coding of variables	Not applicable to this research
7. Coding	Use multiple coders	Codes were compared between different websites and different documents
8. Final reliability	Calculate a reliability figure	Not applicable to this research
9. Tabulation and Reporting	Present figures and statistics	Concepts extracted are used in the pilot case study

There are different benefits for using content analysis as Bryman and Bell have

acknowledged. Firstly, content analysis is a clear and objective method, which can be replicated. Using content analysis to investigate secondary data is unobtrusive and does not require the presence of the researcher, which means that the researcher's presence does not affect what data is collected. Finally, the research can be carried out remotely, through using the Internet to access document management systems, which does not require the researcher to be on site in the healthcare organisation (Bryman & Bell, 2007). On the other hand, Weare and Lin (2000) highlighted that applying content analysis on the World Wide Web can be complicated and unpredictable because of the temporary nature of Web pages, as complete websites and many webpages are updated or terminated. It is certain that the results presented in the content analysis report will change; there will be different eHealth strategies and different implementation plans. However, those results are still indicative of the motives and objectives of those strategies and plans. It also shows the interaction between the different stakeholders that create and implement the strategies and plans. In this research, content analysis has been used in the exploratory, pilot phase, which provided information to set the research up for the main case study.

3.4.6 Framework analysis method

The framework method of qualitative analysis was developed by qualitative researchers into a robust and comprehensive process over the last two decades by an independent research institute in the UK. This framework allows researchers to work methodically to analyse raw data, and convert it into concepts that explain and improve the understanding of social behaviour (Ritchie et al., 1994). The development of some of the features of the framework analysis method was influenced by the applied social policy. For example, applied social policy research aims at finding answers to issues, often in a short time span. Therefore, the aims of the research must be specific to what is under study (Ritchie et al., 1994). Such conditions are similar to the case study conducted in GJNH. In addition, there is a growing need for transparency in the analysis process so that the assessors of the research can understand how the findings were reached. The framework method has founded analytical stages that enable assessors to review how the final interpretation is developed, consisting of data analysis, developing a theoretical framework, indexing, charting, and synthesising the data (Ritchie et al., 1994).

Data analysis. The first of the analytical stages refers to researchers immersing themselves in the data in order to familiarise themselves with it, and acquire a general understanding of the main themes and ideas in the data. This involves reading and re-reading interview transcripts in order to achieve such a level of understanding, which is called the familiarisation process. Each researcher does not necessarily need to read the transcript of each interview in the whole dataset; however, if the researcher has not been part of generating all of the data, more effort may be required to fully familiarise oneself with the data (Ritchie et al., 2003).

Developing a theoretical framework. The next step of the process is to develop a theoretical framework. During the familiarisation process, the author made notes of the main ideas that appeared frequently in the data. These recurring ideas from the familiarisation process were then gathered into groups of similar themes in order to be structured into a conceptual framework or index (Ritchie et al., 2003).

Indexing. In the third stage of the framework analysis, indexing is applied back to the transcripts of all the interviews to test its applicability. At this point, the researcher participates in the time consuming and laborious act of going thoroughly through all the data in the transcripts and mapping it onto the noted themes of the drafted theoretical framework. Notes made during the familiarisation process provided guidance for this phase. There are two ways to index the data. The first way is to code and annotate the themes from the draft framework, alongside corresponding the transcripts (Ritchie et al., 2003). Another way is to copy the appropriate data from the transcript, and pasting it into another file, such as an MS Word document. This process can also be carried out using a computer's qualitative data analysis software program that is suitable for managing and storing such data during the analysis process.

Charting. At this stage, the data is summarised into charts according to the themes it was indexed into, in relation to the theoretical framework; the data is summarised into thematic charts (Ritchie et al., 2003). Those summaries reduce the original data into manageable sections of text that are easily visible. These summaries are then placed into the appropriate themes on the theoretical framework.

Synthesising the data. The final stage of the framework analysis process is around mapping and interpretation in order to synthesise the data (Ritchie et al., 2003). At this stage, charts are reviewed to allow the researcher to make sense of the entirety of the data. This can include checking the transcripts and the summaries on the charts against the original data, or relating themes and sub-themes to each other. Such activity can result in merging themes and sub-themes, or moving a sub-theme into another theme or category. When reaching this point, the descriptive summaries in the charts are assimilated into explanatory accounts that clarify the data (Ritchie et al., 2003). The theoretical framework can also be revised further at this stage.

3.5 Research design

This section describes the design of the research and clarifies the research procedure for each of the methods used, which are interviews, surveys, content analysis, framework analysis, and case studies. The plan for conducting the research and applying those methods are described in Section 3.6: Data Collection. Findings, analysis, and interpretations are discussed in detail in Chapters 4 and 5 for both quantitative and qualitative research.

The research started in mid-2011 and was completed in early 2014. It went through two phases. The first phase was mostly exploratory, took place in 2011 and 2012, and provided guidance around themes and questions to focus the research. The second phase began in 2013 and was completed in 2014. It provided detailed viewpoints on the issues identified in the first phase, mainly through the explanatory case study conducted at GJNH in Scotland. Related to these two parts, the research approach contained two methodological themes: qualitative and quantitative. The primary portion was qualitative, with the quantitative approach being used to enhance and triangulate the issues identified in the qualitative section.

Table 3.8 provides an overview of the research approach highlighting the phase and the orientation. Two healthcare organisations participated in this research; IB Salud during the exploratory phase, and GJNH for the main case study.

Table 3.8: Research design

Phase	Qualitative	Quantitative
Directional (2011-2012)	Pilot case study at IB Salud	Content analysis of websites and documents
Detailed (2013-2014)	Main case study at GJNH	Confirmatory survey at GJNH

3.5.1 Interview plan

The interview research adopts the semi-structured approach. In contrast to structured interviews, semi-structured interviews do not need the exact same set of questions to be given to each interviewee. This method acknowledges that each respondent is unique, and each respondent is motivated by different subjects and specifics. The guiding questions for the interviews are presented in Appendix A. The researcher takes notes for each interview, and compiles them afterward. During the GJNH case study, interviews were recorded electronically, with the consent of the interviewees, and were then transcribed. After which, the transcripts were edited, and coded according to the framework analysis process, described above.

3.5.2 Survey plan

According to Bryman and Bell, survey questionnaires allow for quantifiable data to be collected and analysed with statistical methods. Additionally, the use of an electronic survey allows distant respondents to be contacted quickly and at low cost (2007, p. 241).

Survey questions in this research are built based on the themes in the D&M model, and other themes from the case study. Prior to the survey being published, an ethical review was conducted. The distribution of the survey was done through the GJNH management sending a link to the electronic survey directly to participants' email addresses. Respondents were informed that participation in the survey was voluntary. In addition, the survey clearly identified that data collected would be regarded as private and confidential, and would be stored securely on the Manchester University survey server. Respondents could voluntarily provide their name and e-mail address. The survey questionnaire was prepared using the Manchester University survey online electronic software 'Qualtrics'. The survey was then sent to all 250 users at GJNH. A list of the questions included is listed in Appendix C.

3.5.3 Case study plan

The exploratory pilot case study at IB Salud was conducted in mid-2012 through a series of interviews with decision makers and influencers of the eHealth implementation there. The researcher had a good relationship with the organisation's key stakeholders who were interested in contributing to this research. The Chief Information Officer (CIO) sponsored the engagement and organised the interaction with the rest of the team. However, no commitment was made to share feedback or findings with the organisation. The main case study at GJNH took place in mid-2013. Interviews were conducted with a wider range of decision makers and users. The Chief Executive Officer (CEO) sponsored the engagement, as well, while the CIO acted as a partner of this research facilitating engagements, helping with scheduling meetings through his assistant, and providing the needed documents. Feedback was shared at the interview stage, and a formal management report was provided after the survey, as GJNH requested. GJNH treated this research as an important initiative that can help them evaluate where they are in the eHealth implementation, and accordingly, plan for improvements.

Case study unit of analysis. The research question of this thesis is to test the applicability of the D&M IS implantation success for eHealth implementations. Accordingly, the unit of analysis for the case study research is eHealth implementation success. Yin considers the unit of analysis an essential component for outlining the boundaries of the case study, and for "defining what the case is". He adds: "the unit of analysis is related to the way you have defined your initial research questions" (2009, pp. 29-30). eHealth implementation success is defined through the perception of stakeholders involved in the implementation, and by measurable factors outlined in the D&M model and other theoretical frameworks. Implementation success is defined by many factors, themes, and constructs like project success, users' satisfaction, and delivery of the expected outcomes. Those factors and constructs are grouped in existing frameworks like the D&M model.

3.5.4 Content analysis plan

The content analysis method was compatible with the steps listed by Neuendorf (2002) and depicted above in Table 3.7. The analysis focused on the importance of eHealth in websites and provided documents, the drivers behind it, its strategies and

implementation plans. It resulted in highlighting important constructs, which were used in building the structure of the interviews and the questionnaire, later on. To reach those constructs, the analysis highlighted the top 10 paradigms that were mentioned most frequently.

3.5.5 Framework analysis plan

In this research, data was produced using digitally audio-recorded semi-structured interviews with different users of the eHealth system and members of staff at GJNH. Interview plans and questions were developed from the D&M IS implementation success model and other literature relevant to IS implementation success, in addition to the findings of the pilot case study. All interviews were transcribed verbatim. Another input of data was in typed field notes that were made after the interview, which mainly consisted of information about the context of the interview, such as the department that the interviewee was part of and its relations with other departments. With the number of in-depth interviews reaching twelve, a certain level saturation of ideas (Ezzy, 2002) related to the purpose and goals of the case study was considered to have occurred. The average time each interview took was about 1.5 hours, which resulted in a considerable number of transcribed pages of data for each interview to be analysed.

Framework analysis in this research followed the exact stages described above in the Framework Analysis Methods section, which was informed by Ritchie et al. (2003). First was data analysis, during which the author undertook all interviews and transcripts, so more familiarisation was achieved. The researcher also wrote the field notes that helped in refreshing the context of the interview. During the familiarisation stage, the research aims and objectives were referred to, to ensure that the data is linked to those objectives.

In developing the theoretical framework stage, the observed recurring themes identified during the familiarisation process were grouped together into similar themes and sub themes, and organised into three main sheets of overarching themes. These three sheets were then populated with ideas that emerged during the familiarisation.

The following stage was Indexing. All relative data in every script was copied and

pasted into one of the three sheets. It ensured the match between the data and the themes. The transcripts, and notes made during the familiarisation stage, were referred to regularly. The author could have used one of the computer programs to do the indexing; however, as he was part of each interview, there was a lot of contextual data that guided the indexing, which would have not been necessarily taken into consideration using the computer program. This choice was also affected by the arguments against using computer software programs for indexing during the qualitative data analysis. Those arguments were summarised by Mangabeira et al. (2004), who warned that computer software programs for qualitative data analysis would not analyse the data for the researcher as the case with quantitative statistical analysis software programs. The researcher must learn how to utilise the qualitative data analysis program to be able to analyse the data. During the indexing phase, the draft theoretical framework can be refined. The indexing process allows the researcher to become immersed in the data. Consequently, it is common to note the need for categories to be merged, or new categories to be created (Ritchie et al., 2003). In this research, the author had to revise the theoretical framework a number of times during the indexing phase.

After indexing, data charts were created on an MS Word document. Summarising data into charts facilitates undivided visualisation of all information. It was important not to discard data if it did not appear to meet the goals of the study. The ability to visualise the data in the charts helps in understanding and interpreting the data set as a whole, and data that appears irrelevant initially, may prove important after charting.

The final stage was synthesising data. In this research all charts were reviewed, and that resulted in changing some categories and sub-categories. It also led into merging some of the themes that appeared to be new, which resulted in the need for further research around those themes. One of the main benefits of the framework analysis is the transparency of the data analysis and the enhanced rigor, which is facilitated by the several distinctive phases of analysis (Ezzy, 2002). Decisions made can easily be reviewed and amended at any stage, if required. Similarly, at any stage, researchers can refer back to the original data, which allows for an iterative process to be applied to qualitative research.

3.6 Data collection

This section describes how the above research methods were applied to collect data in the two phases of this research from 2011 to 2014. An initial view of the data is provided, to be followed by a detailed presentation of data, interpretation, and explanation in Chapters 4 and 5.

3.6.1 Phase 1: Qualitative and quantitative. January 2011 to September 2012

Initial research fieldwork was conducted in 2011. The first part was quantitative examining the content of websites of leading healthcare organisations that went through eHealth implementations, including IB Salud and GJNH. The purpose was to understand how they publically presented the implementations, their objectives, and issues. The content analysis also included documents about those implementations that were either provided or obtained. Coding was conducted during April and May of 2011 by examining any mention of eHealth success criteria. When a criterion was mentioned, it was crosschecked with the standards criteria identified during the literature review. The resulted constructs were used in the interviews for the pilot case study, and are listed below in the case study description.

The qualitative component of this phase consisted of the pilot case study. The research strategy adopted was an exploratory case study about the implementation at IB Salud, one of the large regional implementations of eHealth. The hypothesis was that the implementation would be successful, whether by improving outcomes, or by being perceived as successful by users and patients. The aim was to examine if technology, modelled and implemented to maximise the efficacy and impact of care, was successful in achieving positive outcomes. Consequently, the aim was also to uncover the main reasons behind success, whether it was the software used, the implementation team, management, culture, or a combination of all these factors. Correspondingly, the case study analysed the selected implementation from different aspects, and tried to understand the relations and forces within the organisation, which might have resulted in a successful implementation. As part of the case study, eight interviews were conducted. The main constructs enquired during the interviews emerged from the initial literature review, and the content analysis. The following is the list of those constructs:

- Resourcing and funding

- The role of technology
- Success factors
- Challenges
- Key benefits to the organisation and the community
- Original vision
- The role of project management.
- Ways of engaging the workforce
- The role of patients in developing the eHealth initiative
- The effect of existing eHealth initiatives

Each interview lasted around thirty minutes. Those interviews were conducted with senior executives and members of the eHealth implementation team. The researcher conducted different meetings before the start of the interviewing process to explain the objectives of the research, and obtain the buy-in of the organisation to help in this research. Notes were taken during the interviews and transcribed immediately after each interview. The interviews during the pilot case study were guided by the findings of the content analysis conducted and the concepts that emerged from the literature review. Although the theoretical guides were helpful, the Phase 1 findings pointed to the need for adopting and testing an existing framework of IS success, instead of trying to build a similar one from scratch. It also highlighted more important topics like the importance of including clinicians in the implementation team, the role of project management, and the affect of political factors on eHealth plans and implementations. Those factors led the second phase of the research to examine the D&M success model, and the topics that emerged from the pilot case study. Table 3.9 describes the features of the case study:

Table 3.9: Pilot case study at IB Salud

Period	Organisation	Location	Participants
July to October 2011	IB Salud	Mallorca, Spain	<ul style="list-style-type: none">• Nephrologist• Family Doctor• Family Doctor• Neurologist• Nurse• Chief Medical Offices• General Manager Hospital Son Llátzer• Chief Officer Manager at IB Salud.

3.6.2 Phase 2: Qualitative and quantitative. September 2012 to March 2014

The first part of Phase 2 was the detailed case study at GJNH in Scotland. It was conducted in the period between September 2012 and September 2013. The case interviews included representatives from different departments of GJNH. GJNH's CEO was the executive sponsor of the case study, and the CIO or Head of eHealth was the acting sponsor and organiser of activities. He strongly supported the case study, both as a participant and as an internal owner of the final report. The CIO was interviewed in September 2012, and he commented on the importance and relevance of the research, and his openness to the emerging findings about an augmented IS implementation success model for eHealth.

The case study was explanatory, aiming to explain how different factors and constructs interact and affect success in the eHealth implementation. It also tests applicability of the D&M IS success model and other theoretical frameworks that emerged from the literature review, and were enhanced through the pilot case study. GJNH was selected for the main case study for different factors. The personal interaction of the researcher with the organisation, in addition to the content analysis conducted in the first phase showed a strong commitment of the organisation to eHealth. This commitment and full support given was an important factor in the interest of GJNH in this research. It is a national hospital that does not cater to one region, but the whole country. This gives the hospital wide exposure when it comes to physicians practicing in the hospital, and patients being referred to it. It is also a tertiary hospital with high-end services, and specialised practices, which means a higher concentration of specialised practitioners. It also means that it has a relatively smaller number of beds (200), providing sophisticated services. Those

characteristics of the organisation make it interesting for the research as it has a wide variety of practitioners and clinicians using eHealth. GJNH has to deliver quality service as it caters for the whole country, which means that its eHealth system has to perform at least as well as its other service delivery initiatives. The sophistication of specialties and services means that a variety of systems were needed to automate the operation. In the Scottish health system, for the above reasons, GJNH can be considered a distinctive case. This uniqueness can be related what Yin described as: “extreme case or unique case” (2009, p. 47), which supports the rationale for a single case. Although there are other hospitals providing similar services and implementing eHealth, this case provides a unique model for testing the D&M IS implementation success factors. More details about GJNH are mentioned in the case description in Chapter 4. The case study at GJNH went through four stages, as described in Table 3.10 below.

Table 3.10: GJNH Case Study Stages

Stage	Main Activities	Time Frame	Results
Introduction and planning	<ul style="list-style-type: none"> • Meet sponsor • Define case study scope • Review background documents • Review research literature 	One week on site in September Six months offsite: from October 2012 to February 2013	<ul style="list-style-type: none"> • Agreement to proceed • Discussion Framework • Terms of reference • Interview schedule
Initial field research	<ul style="list-style-type: none"> • Conduct interviews • Collect documents • Prepare transcriptions • Consolidate notes • Initial feedback to management 	-Two weeks onsite in March 2013 Three months offsite from April to May 2013	<ul style="list-style-type: none"> • Interview transcripts • Initial results • Further action • Initial analysis and report
Further field work	<ul style="list-style-type: none"> • Conduct additional interviews • Revisit initial interviews • Preview related literature • Prepare initial report to management 	Two weeks onsite in June 2013	<ul style="list-style-type: none"> • Final key themes and findings • GJNH management report
Final analysis and report	<ul style="list-style-type: none"> • Write and communicate findings and analysis 	Two months offsite in July and August 2013	<ul style="list-style-type: none"> • Final analysis and reports

The preliminary part of the case study included the initial contact between the researcher and GJNH. At this stage, the researcher established his credibility with the leadership team. He also built the credibility of the research. The researcher agreed on the terms of reference for the study and the dialogue outline for the interviews. This phase was initiated in September 2012 and ended in February 2013. It started with face-to-face meetings with the research sponsors in September 2012, which took place in Glasgow. During the six months to follow, many conference calls were conducted. Those conference

calls focused on the terms of reference, the discussion standard, and the logistics, which organised who would be interviewed and when during the interview period.

The second part of the case study was a concentrated two-week period of interviews and meetings, which took place in March 2013 on the GJNH campus. Twelve interviews were completed during that time. The interview framework is included in Appendix A, while Appendix B provides a list of the interviews conducted. All the interviews were digitally recorded and were then transcribed and reviewed by the researcher. A total of 17 hours of interviews were recorded, with an average time of 90 minutes for each interview. The interviews were mainly conducted in the interviewees' offices or the meeting room. Some of the interviewees provided supporting documents that explain and verify the points they wanted to make.

The researcher scrutinised each interview transcript to extract and label key themes. All themes were colour coded to classify their occurrence across all interviews, and to catalogue them into three categories: themes covered by the D&M IS success model, themes that are covered under other success models theories, and other themes that need to be studied further. This activity allowed the researcher to quantify, organise, and prioritise the key themes. Miles and Huberman clarify this process explaining that "Codes are used to retrieve and organise ... the various chunks so the researcher can quickly...cluster the segments relating to a particular research question, hypothesis, construct, or theme. Clustering... then sets the stage for the drawing of conclusions" (1994, p. 57). The coding approach dividing data into three theoretically backed categories, helps in understanding the context in which the data occurs, and as Miles and Huberman added: "to see how it functions or nests in its context, and determined by how many varieties of it there are" (1994, p.57). They also recommend continuous coding, which should be done immediately after the interviews, rather than later in the data collection process: "because late coding enfeebles the analysis" (1994, p.57). In this research, the investigator reviewed the key themes of each interview at the end of the day in which it was conducted, before the next day of interviews, and the analysis of transcripts. This allowed preliminary analysis to enrich the following set of interviews. Miles and Huberman (1994) highlight the importance of such practice in field research: "The ultimate power of field research lies in

the researcher's emerging map of what is happening and why... Coding, working through iterative cycles of induction and deduction to power the analysis, can accomplish these goals" (p. 57). The full set of themes and constructs, under the three main areas identified above, are summarised in Chapter 4. A list of interviews is presented in Appendix B.

The third part was conducted after the primary analysis, and included secondary fieldwork, reviewing the initial findings and collecting further data. During that stage, documents, which were identified during the interviews, were obtained. Three follow-up interviews were conducted to address some of the areas that required further information. This phase was completed in June 2013.

The fourth and final part of the case study at GJNH included sharing information with key stakeholders for discussion, and when applicable, for planning reasons. The researcher delivered a management report to the GJNH sponsors about the results of the case study. This allowed the researcher to substantiate initial interview findings, to explore the categories developed through the interviews, to develop an emerging updated eHealth success model with the GJNH stakeholders, and to continue on building trust with and earning the support of the sponsors for the research. Both sponsors were very receptive to the interpretation of the findings in the report, and their applicability to the implementation at GJNH.

The quantitative phase 2 consisted of a survey that was done at GJNH. This quantitative research was deductive, aiming at testing and validating the findings of the qualitative case study completed at GJNH. The survey, which was designed in September 2013, consisted of questions that were prepared based on the findings of the case study at GJNH. It was then shared with the head of eHealth and his team to provide input and clarification to the survey questions, and how the users would perceive it. Accordingly, the questionnaire was refined and was ready to be shared.

Firstly, a pilot survey was distributed to a selected group of 10 users, who were involved in the implementation. The pilot responses gave guidance to changing some of the questions to make them relevant and more understandable to the wider audience at GJNH.

The pilot and the analysis of its responses were concluded in October 2013.

The main survey was distributed through the eHealth department at GJNH, to all the eHealth system users estimated at 250 users. It was released at the beginning of November 2013 with a two week response period. The distribution was carried out via emails that had an introduction and background about the research and the survey, with a link to the survey to be filled online. A document version of the survey is provided in Appendix C. The initial response rate was low as the holiday season was at that time; thus, the researcher agreed with the sponsor at GJNH to extend the response time until mid January, with two waves of reminder emails from the CIO encouraging users to participate. By mid January, the survey was taken offline and the total responses reached 58 valid responses. The survey was voluntary and anonymous, although some participants willingly provided their names and emails for follow-up discussion. The responses were analysed using Excel, at the beginning, to get a general idea about the data. Following which, the responses were analysed further using the statistical computer program SPSS, in two stages. The first was a descriptive analysis, which was the base of a management report that was shared with GJNH management. The second was inferential analysis seeking to uncover new relations and facts within the data. A detailed description of the analysis process and results is described in Chapter 5.

3.7 A Critical assessment of the research methodology

3.7.1 Research methodology challenges

The research methodology explained above was subject to several challenges, which are listed in this section. Those challenges were identified in advance based on the methodology research. As the researcher had a fair idea about these challenges, prior to conducting the research, he took actions to minimise the risks, which are explained below.

Preliminary meetings may bias the case study. Usually, after having the initial planning meetings, some contributors may not want to meet for a second time, or may defer the interviews to their subordinates. For example, the CEO of an organisation may agree to an initial one-hour meeting, but may not want to spend another one or two hours in an interview. This happened with one of the executives during the pilot, who did not have

further interest in discussion after the first meeting. However at GJNH, many initial meetings took place before the start of the interview phase. The more discussions and meetings GJNH people were engaged in, the more their interest in the research grew, and the more time they gave to the research. In this case, the initial meetings were valuable marketing and awareness tools about the importance of the research, and its potential findings and forecasted impact.

Interviewees may be hesitant to disclose full information. Different participants were part of the eHealth implementation and could have been reluctant to share information about the implementations, especially if it has to do with any negatives. Non-disclosure and other signed documents that guarantee confidentiality and anonymity may have been insufficient. Yet, trust and confidence in the researcher were essential to get the required access to information. In the case of the GJNH, the trust between the researcher and the organisation was built over a relatively long time: there were the initial planning visits, the pre-case meetings, the interviews, and the survey. A mutual understanding and respect of each other's priorities was developed. Many of those priorities were shared since both parties want to better understand success in eHealth. There was an agreement that the names and actual titles of the interviewees would not be disclosed, and that the full draft of research findings be shared with GJNH prior to publication.

High potential costs of case studies. Case studies can be challenging in terms of costs and resources that they require. In a case study, time to complete and the size of data available to be gathered, may be excessive. Yin warned of such possibility: "Do not underestimate the depth of your challenge" (2009, p. 3). The GJNH case study necessitated three visits to Glasgow for a total time of about five weeks, in addition to many conference calls. Although there was no cost associated with transcribing over 15 hours of interviews, as the researcher did that himself, that task was very demanding in terms of pressure on the researcher's time.

During the case study that spanned over more than a year, there was a considerable investment in time and money. This investment has contributed to the trust and support of the case participants. For example, in an industry conference that took place in Glasgow in

September 2012, representatives from GJNH talked to other organisation members about this research, and discussed with them views and opinions about the success in eHealth implementations.

Researcher bias. One of the main challenges that can face any research, and should be addressed, is the researcher bias. Social research literature discussed this area in depth as researchers might bring their experience and potential pre-conceived ideas to the study. The way we perceive the phenomena we study is affected by different factors; one of these conceptions is what we already know about them (Bryman & Bell, 2007). Accordingly, a CR perspective requires the orientation of the researcher to be clarified.

To address this challenge the research proposal has been presented to experts and academics at different events and conferences. The purpose was to understand and minimise potential researcher bias. At the findings stage, similar steps were taken. Initial research findings have been shared and discussed to improve the study method and to minimise researcher bias.

The researcher has a strong industry experience in eHealth, having been a senior manager at Microsoft, Allscripts, and Orion Health dealing with eHealth for over 15 years. Both case studies were introduced through formal colleagues and existing relations. The researcher's experience allowed him to build credibility quickly with the interviewees, which was useful in gaining trust during the interviews. Furthermore, having industry experience allowed the researcher to comprehend the theoretical models used in the case to explain eHealth implementation success.

Selecting characteristic research participants. One of the main challenges of the research strategy, in general, is the method of selecting participants in the research. Initial respondents in the pilot case study were arranged through personal contacts from the industry. However, in general, the selection pool is biased because participants are personnel who have been participating and engaging in the eHealth implementation, which necessarily means that they have a certain bias towards the project, and how they evaluate its success.

Individuals in that group were more motivated to talk to the researcher than the average users that were not part of the implementation. The researcher has mitigated this risk by asking to interview known critics of the system. The sponsors at GJNH were supportive of this approach as they were looking for reliable outcomes from the research. Another means of mitigating this risk, and getting a better indication for generalisation, was done through a complete additional stage of this research. The survey was added to get the view of the wider audience at GJNH to see if the general population's view at the hospital matched the view of the selected few for the interviews.

Rapid changes in the research topic. Another challenge is the fast pace of developments in the field of eHealth, and the circumstances and views around an eHealth implementation. Until the time the research was concluded at GJNH, the eHealth implementation was on-going, and the general feel about it was positive. However, user perception can change, in addition to the level of service, stability of technical systems, and many other aspects.

Exemplifying rapid change in the area of eHealth is what happened in the pilot case study, which began with a wide buy-in and support of the project from stakeholders and the government. As the government changed, the leadership of the public health organisation changed, and the existing eHealth initiatives received less attention from the new administration, which affected its overall achievement. This is why the research at GJNH looked at success in eHealth implementation at the time of the research, with an orientation of understanding success in eHealth implementation, and not strictly defining every factor of it.

3.8 Summary of research methodology and chapter conclusion

This chapter has offered a step-by-step path of the research methodology. The chapter describes: the philosophical foundations for the research, the overall research approach, the design of the research including the research's implementations for specific techniques, and the collection of the research data. The challenges to the adopted methodology of this research were also discussed, at the end of the chapter.

CR forms the ontological base of this research. It suggests that reality exists but that our ability to realise that reality is challenging and requires multiple actions and research techniques. Accordingly, this research uses an approach that includes both qualitative and quantitative methods to triangulate and tackle the discrepancies of each separate research method.

After CR is established as the philosophical research basis, the mixed methods research approach is described. Following, each individual research method is described: case study, interviews, survey, and content analysis. Subsequently, the validity and appropriateness of the methods is defended. This chapter also describes the multi-phase, mixed-methods data collection approach, in addition to the actions that took place between 2011 and 2014. Finally, the challenges of the selected research methodology are listed and discussed.

The following two chapters describe, analyse, and interpret the data collected using the research methodology described in this chapter. The qualitative portion, mainly the case study at GJNH, is described in Chapter 4. Next, Chapter 5 describes and explains the data collected through the survey conducted at GJNH.

In the next chapter, the initial findings and interpretations from the main case study at GJNH are described, and initial relations to the D&M model and other theoretical frameworks are discussed.

CHAPTER 4. GJNH CASE STUDY

4.1 Introduction

Previous chapters have described the growing importance of eHealth in healthcare organisations, and the main themes that were examined around eHealth and implementations of eHealth. Those chapters also summarised the literature around implementations of eHealth, and the definition of success in Information Systems implementations. Different factors related to IS systems, leadership, individuals, and organisational structure and governance emerged as factors associated with successful applications of eHealth. It was clear that various healthcare organisations viewed eHealth as an important initiative, and a part of their continuous efforts to improve the quality and efficiency of the services they provide. It was also clear that a variety of healthcare institutions seek success in incorporating eHealth systems in their practices, and had different views on what success means, and how it can be achieved (Greenhalgh et al., 2011).

This chapter examines the interactions and relations between the abovementioned definitions of success, and the achievement of a successful eHealth implementation through a case study at Golden Jubilee National Hospital (GJNH) in Scotland, which recently went through an eHealth system's implementation. The case study examines the relative applicability of eHealth implementations success definitions and factors, using the theoretical lens of the D&M IS implementation success model (Delone, 2003) and the themes of other theories that emerged from the literature search. The empirical context of the eHealth systems implementation at GJNH provides strong evidence of contemporary practices to which theoretical frameworks can be added to create a model for others to emulate.

In this case study, 12 interviews with executives and senior managers, clinical leaders, and administration personnel were conducted at GJNH (a list of the interviews is provided in Appendix B). The purpose of the interviews was to test the applicability of the D&M IS implementation success model in the eHealth implementation domain. It also looked for other potential eHealth specific success factors related to various challenging aspects of the healthcare context, like; clinical personnel involvement, the wide range of

stakeholders involved, and the complexity of healthcare service delivery.

This chapter describes the case findings and goes on to analyse the applicability of the D&M IS implementation success model in GJNH, followed by testing the applicability of other theoretical frameworks uncovered through the literature search. The final section provides an analysis of the alternative themes that can be further explored, and potentially added to augment the D&M model to make it more suitable for an eHealth implementation specific context.

4.2 Case Description: eHealth implementation at GJNH

GJNH has been in operation for ten years and is one of the national hospitals in Scotland, located in the Glasgow and Clyde area. A national resource for NHS Scotland, the GJNH is home to regional and national heart and lung services, is a major centre for orthopaedics, and is the flagship hospital for reducing waiting times in key elective specialties. It houses 200 patient beds, four cardiac catheterisation units, 16 theatres, and a state of the art diagnostic imaging suite. 1400 staff work at the hospital in addition to 100 volunteers delivering 30,000 procedures per year (GJNH, 2014).

The GJNH went through the eHealth implementation, as part of the Scottish published eHealth strategy 2011-2017. The national strategy, which is set within the context of the NHS Scotland (NHSS) Quality Strategy and its associated finance strategy, promotes a change of emphasis towards an outcomes-driven approach based on five broadly defined outcomes:

1. Maximise *efficient* working practices, minimise wasteful variation, bring about savings, and raise value for money;
2. Support people to *communicate* with NHSS, to manage their own health and wellbeing, and to become more active participants in the care and services they receive;
3. Contribute to *care integration* and to support people with long-term conditions;
4. Improve the availability of appropriate *clinical information* for healthcare workers, and the tools to use and communicate that information effectively to improve quality;

5. Improve the *safety of people taking medicines* and their effective use.

GJNH worked on implementing the national strategy through a Local Delivery Plan (LDP). In the first phase of the planning period (2011-2014), GJNH focused on advancing and participating in the activities and developments listed below. Suitably, the eHealth projects addressed these activities and developments:

- Work to implement an agreed Information Assurance Strategy
- Have well established programmes to reduce the dependency on paper and to implement technologies to include; Electronic Document Management Systems, digital dictation, voice recognition, and collaborative technologies including video conferencing
- Develop a new strategy to cover the range of electronic contact between individuals and the NHS
- Develop a new health and social IT strategy in partnership with local authorities
- Introduce electronic Key Information Summaries (e.g., for palliative and Long Term Care
- Take action on “real time”, local quality improvements and performance monitoring data
- Use clinical portals (or electronic windows to information) to access, at point of care, the priority items agreed by clinicians throughout all territorial boards
- Make up-to-date electronic medication summary available to the appropriate healthcare workers involved in a patient’s journey through the healthcare system
- Integrate with the Patient Management System to facilitate the recording and reporting of information that supports better management of Infection Control

4.3 Findings of qualitative research

The design of the interviews focused on two main areas that resulted from the literature review as frameworks to examine and test in the case study. Those areas were the themes of the D&M model of IS implementation success, and of other theoretical frameworks, identified in the literature in relation to other general aspects of implementing IS projects as project management and enterprise communications, including those

summarised by Abdullah (2012). After conducting the case study and evaluating the responses, another distinctive area emerged, which is the themes brought up by the interviewees, which were not part of the original set of questions related to the prior two areas. Thus, this chapter organises findings under the three categories highlighted above: the D&M model, other theoretical frameworks, and new themes emerging from the interviews.

4.3.1 The D&M IS success model and the GJNH eHealth implementation

The categorised findings of the questions related to the D&M success model, which was discussed in section 2.4 of the literature review are listed in Table 4.1. This section will then go into more details of the different themes and constructs of the D&M model related to the eHealth implementation at GJNH.

Table 4.1: Qualitative findings related to D&M IS success model

D&M Model Themes Constructs emerging for the GJNH Case Study	eHealth Specific Constructs
System Quality	
<p>User Friendly:</p> <ul style="list-style-type: none"> • Easy to use; intuitive • User interface that looks and works like personal systems like Google, Apple • Application design in collaboration with the end users <p>Technical Quality:</p> <ul style="list-style-type: none"> • Gets the information reasonably quickly • Cutting edge • Good infrastructure • System availability of 99.9% • Fast • Works for everybody <p>Integrated:</p> <ul style="list-style-type: none"> • Best of breed systems • Portal as a main access point on top of other systems • Fragmented versus integrated/unified. • Multiple user interfaces versus one user interface. • Requires multiple passwords versus unified password (negative). • Good connectivity between different systems through a portal. • Systems that are not integrated to the rest of the systems (negative). <p>System implementation:</p> <ul style="list-style-type: none"> • System is built through an iterative process that went through 20 iterations. • The quality of the eHealth department. 	<ul style="list-style-type: none"> • System that supports patient care • Makes clinicians effective and more productive • Helps clinicians in their day-to-day job by providing information • System is built through the feedback of Doctors, Nurses, Pharmacists, administrators, eHealth and IT members • Delivers on the clinical strategy • Best of breed systems to meet clinical requirements (radiology, theatres, etc.) • The eHealth system integrates with other systems across the country.
Information Quality	

<p>High Quality:</p> <ul style="list-style-type: none"> • User friendly • Easy to analyse • Easy to interpret • There are no duplicates • Accurate • Trusted • High quality reports, clinical and financial <p>Process:</p> <ul style="list-style-type: none"> • There is a specialised department for information quality • No need for highly skilled resources to write reports • The same source of information can be used in different ways for different uses • More work can be done on statistical analysis and generating trends <p>Management Information:</p> <ul style="list-style-type: none"> • Delivery against patient pathways • Waiting times • Performance of outpatient sessions • Performance of theatre • Information help in delivering senior management targets <p>Information Reporting:</p> <ul style="list-style-type: none"> • Information is cascaded, and reported to the government of different performance measures through the government performance framework • Each clinical division data • Subset division and related outcomes: clinical governance, performance, financials, rosters, utilization of beds, to link to overall government performance to make sure that it is reaching certain levels • Board level reports including complains, issues with patients • Government reports on national performance targets: financial targets and patient safety 	<ul style="list-style-type: none"> • Involvement of clinicians improves information quality • Provides clinical information, and management information. • Clinical outputs, includes; Operations Notes, Discharge Summaries, clinical pathways... • Easy and fast to retrieve patients' information (e.g., results, notes, and plans). • Standard formats and clinical documentation, which make it easy to exchange and interpret. • It also produces information for external monitoring. • Clinical information, more can be done around: <ul style="list-style-type: none"> ○ Clinical outcomes. ○ Mortality and morbidity. • Improvements are needed to get patients' records nationally. • The information available provides what clinicians need quickly.
<p>Service Quality</p>	
<p>Technical Support:</p> <ul style="list-style-type: none"> • Structured help desk • Issues are expected to be solved within one hour of the call • Good quality support service • Proactive • Uses proper systems for helpdesk and bug fixing • Fast service through electronic forms • Helpdesk system set against service level agreement • Well-staffed IT department servicing a reasonable size organisation • Constant refreshment of hardware <p>Role of eHealth Department</p> <ul style="list-style-type: none"> • Project group is set up for each initiative • It is very helpful • Gives feedback on issues, the possible solution, and timeframe • Limited with funding and expertise (negative) <p>Delivering Beyond Expectations</p> <ul style="list-style-type: none"> • eHealth project manager to take support calls herself • An enabler of change and special projects • Approachable with personal relationships with end users • Provides education to small groups on applications' use 	<ul style="list-style-type: none"> • Clinicians are involved in service delivery • Connects and plans with clinicians • Focused on creating operational value for clinicians and management

<ul style="list-style-type: none"> • Personal interaction is possible when more urgency is needed • Direct attention from the eHealth department showing users what they need to know in the system directly and one on one • Open dialogue between departments, and discussions around issues and problems 	
System Use	
<p>Use measurement</p> <ul style="list-style-type: none"> • Statistical reports show continued increase in the use of the eHealth system. • 90% of medical staff using the system. • The system usage is low (Negative). • Satisfaction is low (4 out of 10). <p>Purposes of use</p> <ul style="list-style-type: none"> • The system should be at a level that allows users to do their job. • Enables hospital operation on a day-to-day basis. • Provides management reports. • Enhances efficiency and productivity. • Compliance through system usage. • Highly used that some paper operations are switched of directly as the eHealth system is live. • Some departments use it more than others. <p>Use factors</p> <ul style="list-style-type: none"> • Having IT support close enhances usage. • Usage is increased based on business priorities. • In building system usage you go into stages, you always have early adopters, the mass of users, and the group that shows resistance. • Usage is increased through engagement and giving live demos highlighting the benefits and problems solved. • The more the system is used, the more connectivity it provides, and makes users demand access to the system. • System use through peer pressure where the non-users stand out. <p>Areas or resistance:</p> <ul style="list-style-type: none"> • Moving from paper to electronic forms on the screen. • Signing off documents electronically. 	<ul style="list-style-type: none"> • Supports referrals, demand, and patient management. • The system is being used, especially to access patients' information. • Old clinicians represent the main challenge to system use. • Moved the clinicians from paper notes and documents to electronic notes and documents. • Using clinical portal all clinical information is available to any clinician in any part of the organisation. • System use, solved most of clinicians' problems. • Integrated to the clinical process. • The use will increase as users realize the benefits of using the eHealth system.
User Satisfaction	
<p>Measured satisfaction</p> <ul style="list-style-type: none"> • Users satisfaction is studied, and results showed users' satisfaction • It's an on-going process; there is always room for improvement • Will become more useful and dependable as more systems get integrated to it <p>Satisfaction factors</p> <ul style="list-style-type: none"> • Systems provide what they are supposed to provide • Systems enabling users to do their jobs professionally • Users are satisfied because the system provides what they need • Systems enabling users to do their jobs professionally • Proactive support, and support management • Good infrastructure • eHealth department is involved and close to people • Good support, and solving users' issues • People orientation eHealth staff • Good change management and communication around new systems and developments 	<ul style="list-style-type: none"> • It solves clinicians' problems • It makes clinicians' lives easier New initiatives like tele-Health

<ul style="list-style-type: none"> Organisational culture, and how electronically literate users are 	
Net benefits	
<p>The system is beneficial because:</p> <ul style="list-style-type: none"> The eHealth system is accessible from any PC and with the same username and password Increased ability to find information remotely Improves time management Provided information for performance management Facilitates audit Dependable Solves problems Produces useful data sets for critical governance, and society specific requirements Increases efficiency Continuity of business. Used dependably by management. Financial governance. Many performance benefits that can be measured. 	<ul style="list-style-type: none"> No need to login to different systems to access patients' records Improves accuracy and patient safety Improves patient care Produces data for audit and Mortality and Morbidity meetings Produces appraisal data Systems are about fulfilling strategic outcomes like: <ul style="list-style-type: none"> Minimizing waist. Making people more efficient. Supporting clinical decision-making. Being able to access patient's information before the patient arrives to the hospital. Standardization of the practice and the documentation/information formats. Increased productivity through freeing clinicians' time. Increased referrals- This means more patients and makes the hospital more productive. Knowing about patients and connecting with them through shared pre treatment and post treatment reports. Clinical governance benefits. Patient safety benefits.
Overall Project Success	
<p>Success indications</p> <ul style="list-style-type: none"> More access to information Information more centralised to make decisions on. User acceptable interfaces Delivered what it said it would deliver Solved problems Projects delivered their required outcomes It is not about delivering a system and meeting deadlines, it is about delivering results 	<ul style="list-style-type: none"> It makes things easier for clinicians It provides patients with better information quicker

4.3.1.1 System quality

The first success definition in the D&M model is system quality. The users of GJNH have explained system quality in different ways. Nearly the entire small sample of users interviewed thought that the eHealth system is of high quality. Few of them rated it with an actual value like eHealth Professional 3 (EP3) who gave it a rating of 7 out of 10.

One of the first constructs of system quality was user friendliness. Ease of use of the eHealth system seems to be one of the first things that comes to users' minds. Management Member 6 (MM6) emphasised the importance of user friendliness: "The system is also user friendly; the one that we had was not user friendly from the user's point of view, so we had to involve clinicians to make it friendly for all clinicians"(MM6). This sentiment was echoed

in the comments of Clinical User 8 (CU8) who also highlighted the speed and benefit of getting the required information to the clinicians: “It’s easy to use. It’s reasonably intuitive. I don’t think there are many of my colleagues that have difficulties with the software, so I think within that respect the software gets us the information we need from the system reasonably quickly.” The eHealth system, being user friendly and accessible, was evaluated very consistently as a positive attribute.

Another attribute, which was more specific to eHealth, was the *best of breed* approach that the implementation at GJNH adopted. eHealth Professional 1 (EP1) confirmed this approach by saying: “We were in a good position; we were able to bring best of breed systems and then set the portal on top of them.” MM6 explained this notion further by adding: “... we required best of breed systems, rather than having one system overarching that wasn’t best of breed that covers all systems. For example, radiology and theatres; we brought best of breed in each of these areas to support the medical teams to deliver our broad clinical strategy”. Clinical User 9 (CU9) echoed this vision as well by confirming: “I think what we’re trying to do is have something that works with everything and encompasses everything.” The best of breed approach allows for using best fitting systems and functionality for specific departments, rather than using the same system in all departments. Such general systems might not have the departmental specific functionality. However, for this approach to work, there has to be effective connections between the different systems as Management Member 7 (MM7) explained: “... rather than trying to build one overarching system that does everything, we try to build connections between the best of breed systems.” Such connections can be achieved through a portal system, which is what GJNH adopted, as explained by EP3: “There are many applications that are coming under the portal, so things like clinical details of patients are all based in the central system. Also, it has all the infrastructure to capture a lot of the patient documentation.”

Another interesting attribute that combines the importance of connectivity across systems and the friendliness of the system is the user interface approach, brought to light by Clinical User 2 (CU2):

We might think that people don’t rely on user interfaces, but they actually do. And most people..., they’re actually relying on a user interface. Take, for example,

Google, Amazon, Facebook, Apple, email, anything like that. Most people can navigate all that territory quite easily, but when they use the best components they need training for that because it's not obvious. (CU2)

That was a new and notable call for eHealth systems: to look and feel like the commonly used email and social media applications, which would make them more user-friendly and easier to operate by clinical users. CU2 further elaborated using Apple as a pioneer in user interface quality:

That comes from the Apple user interface guideline; it's available on their website and it explains to you where people move their eyes, what to expect, where things need to be for touch interfaces, and so on. (CU2)

Unlike most of the users and management members who were interviewed, despite, or probably because of, his deep focus on user interfaces, CU2 did not think that the eHealth system at GJNH was user-friendly. He even posed the question: "Is it currently a system I would like to use?" and then responded, "No! It's fragmented, it's slow, it includes two user interfaces, and it requires multiple logins." Because of this honest, albeit oppositional view and other views expressed by CU2, we identified him as a *critical champion*, which became one of the new areas that came out of the case study and will be explained later in Chapter 6.

Finally, and probably most appealing and eHealth specific, is the patient and clinical process focus within the eHealth system. Such a measure can be something that eHealth systems implementers look for when planning and putting into action their eHealth systems. eHealth Professional 5 (EP5) describes this approach: "We're always trying to put in place systems that support patient care most and foremost." He goes on to explain:

What I am trying to do is to create an environment where we have high quality systems in place, which have direct impact in making clinicians efficient and more productive, and help them in their day-to-day jobs by essentially giving them information as a by-product. (EP5)

This approach also addresses organisational goals, like allowing clinicians to be

efficient and more productive, which in turn, puts more of the clinicians' time back into patient care. Clinical User 4 (CU4) defines this approach further by talking about the patient journey, and how the system was designed to follow that journey rather than having users gather and assimilate information from various systems. CU4 explains:

We also followed the patient journey. In terms of the GJNH, clinical IT have based themselves around following the patients' journey rather than little bits adding here and there that don't really work. So it follows the patient through from the start of the clinical process, till they are discharged. (CU4)

4.3.1.2 Information quality

Many of the individuals interviewed think that the information provided by the eHealth system at GJNH is high quality, meaning it is accurate, user-friendly, easy to analyse, easy to interpret, reliable, and has no duplicates, which was a sentiment resonated in the comments of MM6: "Again it's high quality, user friendly, easy to analyse, easy to interpret, there are no duplications." Contributing more details, CU2 added: "I think it is of good quality, and I trust it. If I see a set of lab results, or a request, or a PDF copy, or something, I am as secure in the knowledge that this data is accurate as I am with the paper format." The quality of the data and related reports were examined and confirmed by internal feedback and external bodies, as well. EP3 noted, for example, "The feedback that we get from those reports is very good. And we also have to send that to external bodies like CCAD, and ... we know our requirements... So, yes, I would say that the quality is good" (EP3).

The system produces two different sets of data, clinical and management, as identified by the GJNH interviewees. Clinical data includes operations notes, discharge summaries, and clinical pathways. CU4 explained the focus on producing different variations of clinical data in explaining that they decided to create a database that suited their needs compared to usual databases that prioritised data over clinical information:

We turned it on its head and we said we wanted a system that produced clinical outputs such as Operations Notes, Discharge Summaries, Clinical Pathways, and out of that would come the data that is required both for our internal use and external monitoring. So we're at the stage now where the database is more or less finished, but we are developing the outputs in terms of data reports. (CU4)

Users at GJNH are expecting more depth in the information than simple measures, and looking at clinical outcomes, and predictive measures, like rates of death and disease as mentioned by EP5, "... they could monitor mortality and morbidity, and look at some clinical outcomes and so on, but I think that there's a lot of information available to make much more analysis on it from a clinical perspective."

The perception of management data, which monitored different performance indicators of the hospital were perceived by EP5 as "... rich in information, in terms of management information." EP5 goes on to clarify his point of view by mentioning questions delineating the components of the management information that, to EP5, indicate strong practice: "so how do we treat patients through our pathways, deliver against target waiting times, what's your performance of our outpatient sessions, what's the performance of our theatres. So now we've got a clear hand on the management information." More details of management information and reports were elaborated on by MM6 as the: "Subset division and related outcomes from clinical governance, performance, financials, rosters, utilisation of beds, to link to overall government performance to make sure that it's reaching certain levels." These elements are not only used within the hospital, but also cascade across different levels of the national health delivery system and related organisations, which, according to MM6 extend:

... Up to the board level where we can look from high level at that data, but also incorporate to see if there are complaints, issues with patients, and then we get even to a higher level to the government to give assurance that national target, the performance targets, are meeting the financial targets they give us and the safety of patients. (MM6)

In addition to the availability of details, accessibility of information had a notable improvement in relation to the service delivery at GJNH, which was expressed when CU8 pointed out that: "At the moment, we can access lab results from around the country, X-rays from around the country, but not medical records." Patients are able to have feedback about their medical information from one place because of such eHealth initiatives, according to CU8 who noted:

If a patient, for example, would call and ask a question around their own sort of care, or have results come back... the usage of it is very easy... and very quickly to be able to see quite clearly where they're at with the last lab work, with their anaesthesia, and we can see so much more. (CU8)

4.3.1.3 Service quality

The service of eHealth is structured to provide users with technical support. In addition to the infrastructure department, which ensures that the IT setup is robust and up-to-date, the information department maintains the different applications and makes sure their functionality and speed are optimal. EP1 described the eHealth department: "We have a structured help desk, we have an infrastructure department, we have an operations department, and we have an information department, which deals with a lot of applications."

GJNH have set service standards for their help desk to make sure users' experiences are smooth and their internal clients are satisfied: "Certainly if I receive a call coming to the help desk regarding the portal, I expect that it will be dealt with within the hour, if not an awful lot quicker" (EP1). EP1 also makes sure that the service has a personalised element where possible, as she explained: "Unless I am in a meeting, I would pick call up myself."

The use of support technology also helped in increasing users' satisfaction as CU9 commented that the response times for electronic forms is rapid. Such an approach towards service delivery gave the eHealth department a direct role in the overall change of the organisation, and resulted in user satisfaction showed through the comment of EP3:

It seems to be a department that's quite proactive, and one that's involved in change in the organisation. So it's a great enabler for special projects that were kicked off in the past couple of years. Again, I think it comes down to being very open with the various user bases that we have, and we're seen as very approachable. (EP3)

Clinical users also find the eHealth department responsive, and some of them find responsiveness as more important than the actual solving of issues as expressed by CU4: "They respond very quickly. Whether they fix it or don't fix it, you'll get feedback to what

the problem is, and what the likely solution is going to be.” CU4 also believed that the eHealth team spends time with the clinical team and communicates with them, which makes the eHealth department successful: “they always have time with clinicians, and they try to sit with clinicians and plan” (CU4). Even if issues are not completely solved, or resources are insufficient, clinical users find the continuous dialogue with the eHealth department important and beneficial. CU8 clarifies this point by saying,

I think that there’s good dialogue between departments. I think that eHealth department realises there’s still work to be done. I think that sometimes we’re limited by funding, sometimes we’re limited by expertise and being able to do certain things we would like to do, but certainly we’re able to speak openly with the department and advice if we have any problems. (CU8)

The direct communication approach was extended to an educational role to provide users with more insight on how to use the system. CU9 notes: “They also question queries for portal, for example, then what we have is there’s a lead on that project who’s very good in coming along and showing you something that you haven’t discovered yet. So we have an excellent service.”

Such alignment between the eHealth group service delivery and users’ expectations is structured through a helpdesk and service level agreement: “Information that it generates is how calls are open ... We have to have a high closing rate on all calls” (EP5). Such structure on the helpdesk support level is also matched with arranging eHealth projects, and creating project teams and steering committees, as clarified by EP5: “Every time we do a bit of work for a major initiative, I always make sure there’s a project group setup. So the project group reports to the steering group.” There is also an alignment between the service provided by the eHealth department and the overall organisational plans aiming to add value, including “some operational value, for clinicians, and also for managers ...” (MM7). Under this value-based service approach, the eHealth department and its head becomes a partner of clinical departments actively involved in improving their service delivery in which, according to MM6, clinical departments ask for the eHealth leader to work with them: “rather than waiting for us to ask them to work with him.” The same leader was also asked to “take the lead in projects that have nothing to do with eHealth because he has

established such great credibility with the clinical teams” (MM6).

4.3.1.4 System use

Overall, the eHealth system at GJNH is being used, although the extent to how widely it is being used is debateable. eHealth professionals in the organisation seem to be positive and objective about system usage as they have used specific programs to measure system use: “90% of clinical staff use the system” asserted EP1. She went on to say: “I run statistics every month, and within that, I look at the number of logins; I look at documents that are being accessed and those numbers are increasing every month.” System use also depends on individuals and departments, as indicated by EP3 who said, “I think it depends on the individual, really. I don’t have exact figures on system usage ... it’s significant at the end of the day ... from administrative kind of office-based functions where the system is heavily used.” An important factor of system usage is the increase of that usage over time, which shows that the system is being used, and precipitating positive outcomes, which result in encouraging further usage. EP5 demonstrates increasing adoption of the eHealth implementation by claiming “there has been an on-going growing trend. Every month there’s more usage of the system than the month before.”

System usage is driven by the demand for eHealth, which includes specific outputs needed across the hospital’s operation. For example, EP5 explained that to determine whether or not the individual is deriving the best utilisation “on a management basis for capacity planning and for looking at how you’re performing; if you’re getting the best utilisation,” one needs to explore the “demand for the healthcare system, in terms of the referrals, and the information you need.” He also linked the demand of the system with the direct monitoring of organisational goals, such as; efficiency and productivity: “We’re talking about efficiency and productivity all the time. I think the way you can monitor [efficiency and productivity] is by using IT systems, and try to look a bit slicker” (EP5).

The perception of system use varies within the clinical community of the organisation. CU8 thinks that the eHealth system is: “certainly integrated into the clinical work we do.” CU4 used the statistical approach to define his view of system usage mentioning that; “certainly, in our own database, we can order reports on clicks in the

system, and numbers of users and it's very high." He also explained the benefits of using the system in his view, and how that increased system usage by his fellow clinicians: "... the portal has been a major development in progressing towards a unified patient record. It's been one thing that my colleagues said: 'This is great. This has solved most of our problems in terms of accessing data'" (CU4). However, some of the clinical staff have an opposing view to CU4. For example, CU2, the critical champion, thinks that system usage is unsubstantial: "I would say we'd be lucky if the average employee used more than 30-40 % of the systems available." He believes that some of the systems are not being used at all, and he was very critical of those systems: "There are absolutely systems that are not used. I know for a fact that there are systems that are just not used because they're rubbish" (CU2). Yet, he still clarifies that, in general, eHealth systems in the organisation enable users to deliver on their responsibilities. He said, "they obviously have enough to do their job at a basic level, but not as we like to" (CU2). Thus, he indicates that users are not availing the eHealth system to the desired potential. MM6 had a balanced view about the use of the eHealth system in the organisation and indicated "there are some areas it's been used very, very well. Some have been not as well as we liked, but it's just about prioritising which one to take forward." As such, elements of the eHealth implementation have been identified as weak, whereas others have had strong reviews. In the projects where there was a clear need and focus from management, system usage was immediately high. For example, MM6 notes that "... for certain projects and systems, when it was switched on, the paper practice will be switched off, and PACS is an example of that. Others are coming forward."

It was clear, throughout the case study, that system use is not about the technical aspects of logging into the system but rather it is about adoption of the system and change in the way business is handled by the users, especially the clinical community. Adoption and resistance of using the system are affected by various factors. These adoption factors are related to the age of the practicing clinicians or their years of experience, the different settings of automation in different hospitals where clinicians practice, and the proximity of the IT support staff as summarised by EP3:

Unfortunately, some of the old guard, and especially some of the old consultants don't want to go near computers; they don't see it as part of their job. Generally, they get junior staff to do a lot of data entry into the system. It's a very big culture

change for some of those guys. A lot of them have not used computers before. A lot of them also are not wholly based here, so they have different cultures within the NHS or other hospitals that are totally different from another hospital in greater Glasgow and Clyde. The IT service would be different as well. With us being a hospital board we're accessible, while in larger boards the IT support is kind of far off. (EP3)

Refusal to use the system is basically resistance of change and can also be related to maintaining what might be perceived to be associated with authority or security, like signing documents: "... with Winscribe, there's a resistance for not having a letter signed off. Some people don't use it as well as they could, but they would do it when they see the benefits, so you see more people coming on board" (CU9).

MM6 believes that the organisation achieves better adoption of the system through different approaches according to individual situations and says "it's about the best model that would fit that improvement for patients." However, she believes that engagement with the clinical community is the best approach. She explains: "What the clinical team want from the system, and what the management team need from it," and finding a way for both teams to derive what they need from the system is the most effective method (MM6). She added: "It's about winning hearts and minds" (MM6). System adoption goes through different stages, and is achieved gradually by different groups of users' categories in terms of their ability and desire to use the system, according to MM7, who articulates:

It's about building critical mass, and it's about the stage. The way you have your early adopters, you have your mass body of people coming along in an acceptable rate wanting to feel comfortable, and then you have your tail of people who are resistant. (MM7)

MM7 further explains that different groups go through different stages of adoption; peer pressure becomes one of the factors of increased adoption:

... We went through some enthusiast that absolutely became main stream, and now we're in the stage of mocking up one of two sort of remaining physicians, who will

be carried along by peer pressure not by doing things. We're all now doing it, and you're the ones standing out. (MM7)

In addition to engagement, peer pressure, and other factors discussed, sometimes compliance can be the main driver of adoption, as explained by EP5 when he says that sometimes they take a:

... Compliance approach to certain things, so for clinicians in an outpatient clinic when they make a decision to refer the patient, we demand that they fill out an electronic form, so they're making a decision and recording it electronically so we can monitor the compliance rates and things like that. So I would say that there are no clinicians, or actually hardly any clinicians that can go about their business without touching an IT system. (MM7)

4.3.1.5 User satisfaction

GJNH users are satisfied with eHealth, in general, and according to EP1 that was measured in a questionnaire. EP1 indicated that a management trainee was made responsible for evaluating satisfaction, among other things: "He did a survey, and it showed, overwhelmingly, that users viewed it as a very useful tool, it was beneficial, and it was definitely time saving." Approval was also noted in the feedback provided by technical support professionals. "People who are in our services and support functions would get a reasonable feel, I would reckon, and they would feel it if there was noise in the system," EP5 commented.

System satisfaction becomes more significant when users take part in designing and implementing the system, as per the example given by EP3: "This system was designed by heart clinicians, for clinicians, and they were heavily involved in taking the requirements of what the system would look like, so they took ownership of that system." Similarly, users are also satisfied when their ideas and suggestions are translated into actual pieces of work. CU8 explains that individuals feel satisfied "when people have ideas that can be done through projects, and it can begin to happen in a really rapid way, and that encourages people, then, to engage and to move on with the ideas they want for next stage."

Adding to that, what defines the system's minimum satisfaction is its fit for purpose, as EP3 added: "most of the systems are providing what's expected from them, are enabling them to do their job professionally." CU4 repeated a similar notion and attested, "I would rate GJNH very high in terms of delivering what the clinicians need." Predictably, another aspect of satisfaction explained by CU9 is the concept of problem solving: "I think the ability to know that if you have an issue that's going to affect what you do, there's a solution for that."

Satisfaction with the system is also addressed through fulfilling specific needs of users, even if those needs were perceived as insignificant. EP5 explained using two examples. The first example was about providing remote access to the system. He notes that "following up with patients through remote areas using tele-health" is a benefit of eHealth systems. He clarifies, "Using the portal, they can get access to multiple bits of information in the organisation" (EP5). The second was about the use of specific popular devices, "like there's a trend that everybody wants an iPhone and iPads. So we would provide such devices to people that need to access the system from a remote place" (EP5).

MM6 brings to light a management perspective of user satisfaction. She explains that satisfaction is a relative concept, which needs to be constantly revisited because of the changing environment: "Information technology and patient care move so quick... there is always room for improvement." She highlights the importance of a dynamic system that is able to fluctuate with the ever-evolving needs of patients.

Yet another important organisational aspect of satisfaction is expressed by CU9, who attests to the importance of "good change management and communication around new systems and developments ... getting information out to you, so you can basically do whatever you need to do, with minimum disruption to the workload that you're doing." Thus, the importance of the practice of thoughtfully carrying out change within the organisation has also been met with satisfaction.

Lastly, cultural aspects were also identified where culture, in this case, refers to the digital literacy of the people using the system. MM7 explained "... it's a culture thing; it's

how electronically literate people are, how do they expect things to happen. And I think we're a pretty literate culture in terms of IT, here." Therefore, MM7 demonstrates satisfaction with the general technical knowledge needed for successful use of the eHealth system.

4.3.1.6 *Net benefits*

All users interviewed at GJNH think that the eHealth system is beneficial. Some focused on the technical and practical aspects, like EP1 who said, "We have cut out the need for clinicians to login to multiple systems to be able to see the patient record." She elaborated, "So if they login to their computer, they can login to the clinical portal. It is also available from all PCs" (EP1). However, most of the team members, especially clinical staff, focused on the medical benefits related to treating patients. At the top of the benefits list is having an electronic patient record available at any place, any time, with patients' information and history at their fingertips. Confirming this, CU2 explained: "To have an electronic record means that you can just look at it. You don't have to be in the office, so it's hugely beneficial. It improves accuracy and improves time management, potentially, so having a system like that is definitely helpful and beneficial." Such access to patient data becomes more important just before a patient's admission or the critical hour. CU8 highlighted this point mentioning that: "being able to access patients' information before the patient arrives to the hospital or before we see the patient, preoperatively" is highly advantageous. CU8 elaborates this importance: "For me, we're being able to access the information and get informed about potential problems."

The same data that provides patient information is utilised in different ways, such as governance, community reporting, auditing, and even management appraisal of clinical staff, which CU4 clarified:

We have clinical systems, which are useful both in improving patients' care but also in producing data sets that we need for our critical governance, or our society specific requirements of data sets that we need to adhere to. The systems are producing data for our audit for both our mortality and morbidity meetings. But also now produces data of our appraisals. Management is now using the systems' data for their appraisal assessments. (CU4)

EP3 confirmed that view as well in stating that eHealth:

... Makes information about patients more accessible. It also gives the ability to order access to information. Also, the level of data coming out of the system is good for things like performance management. And also the satisfaction that comes from audit. (EP3)

The same view was further summarised by EP5 who said “the system is beneficial because it solves problems, improves patients’ care, produces useful data sets, increases efficiency, and produces data for audit and appraisals.”

Another by-product of the system; standardisation, is highlighted by EP5 who mentioned, “... it’s a unified system that helps in coordination and standards.” She added: “I think with the system that we’ve got in place here ... if you’re CEO, or consultant, a secretary, or a PA we’re all using identical systems, which kind of forces us down the road of doing everything very similarly ...” (EP5). Therefore, the establishment of common documentation is an additional benefit of the eHealth implementation.

The benefits of the system exceed patient data, and related reports and analysis. The system has a direct connection to strategic organisational outcomes, which were summarised by EP5. “Minimising waste, making people more efficient, and supporting clinical decision-making” were listed as tactics of the institution that were deemed important. Operational and financial objectives were also achieved in a number of different ways as described by MM6:

We have increased the referrals, the activity of the business coming to us using the new innovative way of eHealth, so we’re getting more patients. And we do get more patients, so that’s being more productive, and we get them from all over Scotland. And before, we didn’t know about them after discharge; now we do pre-assessment and post-assessment and share them. We’ve got financial benefits; we’ve got safety benefits; we’ve got clinical governance benefits because we can ... see a number of areas on daily or weekly basis so we can keep an overview over things across our hospital. There is a whole range of performance measures that we could actually physically measure (MM6)

Management is using the system dependently, as it relates to management responsibilities. MM6 clarifies: “I can go live here in my office and look at the performance of the orthopaedic ward this week, and how we’re managing this week on a dashboard.” Having such a system provides the ability to generate immediate reports about the operation, which allows the management to take immediate actions to improve positive outcomes and reduce negative outcomes for patients:

In safety, we can look at trend analysis. We can do it on a pretty much live basis. Instead of it being two or three months out of date, information that would come from paper reports, for example, to the board. The reports come from the departments, and [individuals] from the senior team can see if there’s any trend, for example, in medication errors in a certain department, or falls of patients, or arising infections, so we don’t have to wait 4 or 8 weeks in retrospect to see those reports coming through, so you can immediately improve on safety and governance. (MM6)

4.3.1.7 Overall success

Most of the users at GJNH found the eHealth implementation successful and gave specific reasons for why they perceived it this way. For example, EP3 linked it to better access to centralised information that assists in decision making: “It was going on for the last five years and we have more access to information now than there ever was, and it is now more centralised information coming out to make decisions.” Similarly, CU9 commented, highlighting another indicator of system success related to clinicians: “Everything thus far they brought in, definitely makes it easier for myself, it makes it easier for clinicians.” That success was also evident in the patients’ experience by allowing healthcare providers:

To give patients a better and a full answer, and much quicker answer, because if it is on portal then everything is there. You just need to pull the answers without having to wait for a few days till the physician is available (CU9)

CU4 linked the achievement to simple project success indicators like delivery of scope and efficiency: “... there haven’t been any failures. Some developments took longer than expected, and sometimes we came across problems we weren’t expecting, but they

were very good at problem solving.” MM6 reaffirmed that view in noting, “... we’ve delivered. That’s the key thing. All of our projects have delivered; they haven’t failed.” However, she stressed that the core of success is not about meeting deadlines, but about delivering results:

So all of the criteria, the actual team have to demonstrate that and report back to the board, and show the measurable benefits where we met the criteria, and how we’ve now delivered them, and we manage to do that on an on-going basis. (MM6)

Despite the many aspects of implementation success, overall success can be judged over time. EP5 had an objective view of the work they have done so far in attesting: “I wouldn’t say that the implementation is successful, I would say that it’s evolving.” However, CU2 had a completely different view, discrediting the whole notion of implementation success, arguing: “I think it’s got limited success so far to tell you the truth. That’s because we’re, at times, introducing not very good systems.” He then elaborated, giving some reasons for his view that related to a lack of implementation success, which included budget, the implementation plan, and communication:

It would be different if you were to take the budget that we have and multiply it by ten; it would be quicker. There would be more people on board. We’ll get faster transition through all the integration software. Because of money limitations, as well, I expect, I think it wasn’t as well as it could have been. Slow integration, slow implementation of piecemeal systems instead of having to move to all integrated systems, and comms not being as good as they could be about that. (CU2)

Being the critical champion, CU2 earned his title by expressing valid concerns about, and contradictions to the perceived total success of the eHealth initiative.

Users related the perceived implementation success to different factors. Some of the users started with having an overall vision that cascaded throughout the organisation: “... Somebody has to have a vision for IT and eHealth and how it can be used to help the user base, and basically then the patients generally” (EP3). GJNH was unified around one vision that resulted in organisational commitment to eHealth. MM6 explains:

Our vision is to be the highest quality, and to gain international reputation for what we do, and everyone has bought into that, and therefore we determined that eHealth has to underpin that, because you can't be the best at what you do if you don't have the best eHealth systems to support you. (MM6)

The vision resulted in an eHealth strategy document that assessed the existing state, objectives, and plans for the future:

We have a strategy document in place outlining where you are now, and where you want to go. You need to keep orchestrating things by making sure the governance and the resources are in place to accelerate you, to get you to that point. (EP5)

Then the strategy was broken into specific projects, which followed specific methodology, as EP3 explained, "broken down into useful structures, into the programs of work and then to the various projects. I think those projects need to be run with a recognised methodology."

In addition to the vision and strategy, users at GJNH regard engagement with users as one of the main success factors of the implementation. Being close to users and not being remote is essential according to EP1: "My door is always open, and everyone knows my number. There is no question you have to be accessible. The human aspect is the most important." She puts herself in the shoes of her users, having the care of patients and colleagues as the ultimate objective: "I look at it and say if I was still nursing, what would help me to take care of patients, and that has been my underlying ethos for the whole project" (EP1). Clinical users agreed that such close relations were vital: "I think eHealth is successful because they listen, they take on board, and they make change easy for the wide audience" (CU9). CU2 put engagement with users first out of the three success factors he highlighted: "Engage with users, ask users what they want. You'll never get the right answers. However, you have to do it." He added, "So engage with users, have users on board, every level, have good people who understand the issues and the difficulties" (CU2). The other two factors he recommended were vision and leadership in accordance with the views above. "You have to have leadership in the beginning, and a bit of strategy and a vision of what it is it you're trying to achieve," said CU2. CU8 added that approachability

should be from both sides the eHealth team and the clinical team:

The main success factors were approachability from both sides in terms of the clinicians and eHealth staff feeling that they can sit together on a personal level to discuss issues. So it's certainly a very open environment, which helps us choose the right systems to use for our patients. (CU8)

The partnership between the eHealth team and the clinical team also entailed the clinical team participating in developing eHealth applications: "They realised that IT department is an important part of clinical medicine, and they have gone about producing a large IT department. They have involved a number of clinicians in the development" (CU4). He also added another unique success factor, which is the sense of contentedness and job satisfaction at the eHealth department:

I think there's a happy atmosphere down in the IT departments. They seem to be enjoying the job. They seem to be well looked after and respected, and I think that like any others, being well liked and well respected, you tend to perform better. The health of the IT department, I think, is very good. (CU4)

The management team specifically highlighted the notion of clinical-managerial partnership as a success factor:

We have a very affective clinical-managerial partnership within senior management, eHealth, and the clinical teams. You know we see ourselves as one team, there. No management, and then the clinical team. We see it as if this is one team supporting each other to deliver the same outcomes for patients, improved outcomes, and safety. (MM6)

EP5 summarised the factors in his view. He believes that having the right people, clinical and management engagement, tools, and governance are the main success factors:

I think it's about making sure the right people are engaged with, clinical engagement, management engagement, and making sure that you put the right tools in place to support the process, the right budget in place, and putting the right governance in place around it. (EP5)

Ultimately, the implementation would not be successful without planning, energy, and commitment, according to EP5 who said, “they haven’t failed, because we’ve got a lot of planning, a lot of pain, a lot of energy and commitment that we’ve put into them, and we’ve always delivered.”

4.3.2 Themes in other literature

Similar to the D&M model themes, other themes in the literature, which were discussed earlier in section 2.3 of the literature review, do generally apply to the eHealth implementation at GJNH. For the users that did not perceive the implementation as successful, those themes do not apply. However, most of the users perceived the implementation as successful and were able to relate to them as success factors. Appropriately, those factors, were applicable to the eHealth implementation at GJNH. For each of the success factors, the users at GJNH identified specific criteria that contributed to each element of general criteria, like project management, and some of those specific criteria were eHealth specific. Table 4.2, shows the constructs emerging from the GJNH case study under each of the identified success factors.

Table 4.2: Qualitative finding related to success factors in the literature

Success factor Constructs emerging for the GJNH Case Study	eHealth related
eHealth vision and business plan	
<p>eHealth vision</p> <ul style="list-style-type: none"> • The vision of the project is the National eHealth vision. • A weakness of the vision is that it did not have an enforcement mechanism. • A weakness is that the vision is put forward with a top down approach. <p>Implementation plan</p> <ul style="list-style-type: none"> • The plan looked at what they had, what they needed to do, and the systems to be integrated. • The business plan resulted in a roll out plan. • The strategy/plan was to build locally at the hospital level. • The local plan is forward thinking and has a plan to implement different systems. • The plan includes a proposal to update technical infrastructure. • Strategy clears strategic aims of eHealth, which are reflective of the organisation’s needs. • Strategy is about delivering outcomes that benefit patients’ care. • There needs to be a strategy that people work towards. • Local business plan approved by the board, and aligns with the national strategy. • There is an effort to bring everything together and streamline it in one system. • The effort is connected to the national vision on connecting systems around the country. • For users who are not aware of the overall plan, they get regular and particular communication about developments, and how they affect their work. 	

Enterprise Communication	
<p>Communication channels</p> <ul style="list-style-type: none"> • Different Communication channels like emails, flyers, weekly bulletins, and newsletters. • Initial demo to leadership team. • eHealth team to attend regular meetings of other groups to promote usage, in addition to direct visits to users. <p>Communication Process</p> <ul style="list-style-type: none"> • The communication plan is part of the project plan. • Engaging various groups. • The helpdesk setup assists in communications around new systems. • It's formal and informal but mostly informal. • Part of the business plan is an educational plan to show users what is available in the system and how they can use it. • User groups are formed. • Compiling of feedback and monitoring progress and how it fits the business plan. • Communication around eHealth with vendors and external entities. <p>Internal project communications</p> <ul style="list-style-type: none"> • eHealth leadership managed communications. • User groups and project groups, where the project groups took feedback and presented progress to user groups. <p>External communications to the rest of the organisation.</p> <ul style="list-style-type: none"> • It uses the formal organisation's communication channels. • There were delays in the project teams communicating to the rest of the organisation. • The communication with users is just enough, but they would not know about future developments. • Intranet managed by the corporate communication team. 	<ul style="list-style-type: none"> • Every team had a qualified clinician who communicated to the rest of the clinicians' community. • Each project has a clinical representative who communicates with his/her group.
Change Management	
<p>Change factors</p> <ul style="list-style-type: none"> • Direct engagement with users and potential users. • A unique approach was taken, which is a pilot in one department. • Iterative development approach is essential for change management as it always users to participate in change. • There was a change management process as part of the plan. • It is within the governance of project boards and groups. • Involvement is essential for success. • Multiple approaches to change management and system use. • It is based on Champions. • It is important to communicate the end goals to users. • It has focused training sessions. <p>Techniques</p> <ul style="list-style-type: none"> • Project communications channels like Sharepoint. • As much notice as possible of change. • Guidance and support during change. • Everyone is briefed on the risk and issues and proposed changes. • Trade-offs are made between requirements and budget. • Encouraging system use through engagement. • Change management through celebrating success. • It starts with a general communication through an electronic medium talking about changes and how it would affect everyone. • Next step is communicating to the groups involved or affected directly by the system. <p>Challenges</p>	<ul style="list-style-type: none"> • It is easier to change systems with young clinicians that are IT literate. • Senior influential clinicians are selected for project boards to convince others. • Iterative development as a way of engaging clinicians and increasing satisfaction: <ul style="list-style-type: none"> ○ Iterative development techniques help in engaging clinicians as they go through many iterations until they get what they want. ○ Iterative development increases satisfaction as clinicians see the fruits of their labour. • When resistance occurs, the head of eHealth works with involved clinicians on solving the issues. • Change management was done by the clinical team.

<ul style="list-style-type: none"> • The implementation and roll out can be affected by political reasons. 	
Project Management	
<p>Project Management success factors</p> <ul style="list-style-type: none"> • It was setup strategically. • It was dynamic. • They chose the right people. • It involved users. • Project management style was not enforcing, but one of involvement, listening, and engaging. • There was an automation of project process, and information storing and sharing. • They used an agile approach with close interaction with users. • The project manager was hands on and involved with users. • Not much project management was needed, as the system was stable, and the requirements established. • All IT staff were trained in project management. • There was adherence to project process and documentation like initiation document. • Informal project management was maintained. <p>Process</p> <ul style="list-style-type: none"> • Project methodology was used (Prince 2). • A formal project management structure is based on the size and type of the project. • The user group is a wider group or users that the project team worked with. • Project teams are primarily built of users, accordingly most meeting are held after working hours. • The steering group provided guidance. • Project manager coordinating with steering committee. • The project team has regular meetings with both groups. • Project management software was being used. • Small number of project managers. • The iterative development methodology helped in project iterations. • Project management through the external vendor, taking users' feedback. 	<ul style="list-style-type: none"> • One of the main weaknesses was the lack of project management knowledge by most of the users, especially clinicians. • Clinicians involved in project boards and project groups.
Implementation team structure	
<p>Team structure and plan</p> <ul style="list-style-type: none"> • The initial plan was shared with the steering committee and stakeholders' representatives to get their approval. • The implementation team is made from: project team leads, project workers, IT department members, infrastructure team, and clinicians. • Each specialty has a representative in the project team. • The project team presents to user groups and gets feedback and approvals. • Teams are built according to: <ul style="list-style-type: none"> ○ The type of system implemented. ○ The department the system serves. • The chair of the project team is selected based on specialty and experience, and she/he picks their team. <p>Champions</p> <ul style="list-style-type: none"> • Champions of change are important in eHealth implementation, especially Critical Champions, who are critical about everything and think it is not good enough, yet they are very driven, motivated, and good communicators. • Critical champions are fierce protectors of users' interests. <p>Dynamics</p> <ul style="list-style-type: none"> • There is always the need for influencing and to make trade-offs between budget and requirements. • Training was provided to system administrators and end users. • Governance in the project is very important to set up the project team. • No set formula based on project aims and outcomes. 	<ul style="list-style-type: none"> • It is hard for clinicians to represent others, as there are many specialties and related requirements. • Clinical involvement is essential to project success for any system in a hospital setting. • Training provided by clinicians to IT staff. • Clinical systems will not succeed without clinicians. • For each project clinicians are involved according to their specialties. • Clinicians have ownership of the project. • Clinicians' culture is changing; it is more about teamwork. • eHealth involves clinicians and other staff. • Early engagement of the clinical team is important to allow them to determine

	<p>what is needed and communicate that to the eHealth team.</p> <ul style="list-style-type: none"> • Clinical involvement starts from idea generation all the way to closing of the project, and includes all specialties.
<p>The quality of system selection and implementation</p>	
<p>Selection process</p> <ul style="list-style-type: none"> • No formal selection process was used. • The system was selected using the formal framework of the NHS. • There is a formal process that assesses the quality of the product. • Based on the feedback from both meetings, the requirements were written, and the tendering process started. • The system was selected after sharing the requirements and problems early on in the process with potential vendors. • End users are not involved in the selection phase. <p>Selection success</p> <ul style="list-style-type: none"> • The vendor selection has an impact on project success. • The systems selected were acceptable, and with proper communications and other soft factors the implementation was successful. • The less the system quality is, the more communications and management you have to do around it, and vice versa. • Vendor selection was based on reputation and track record in similar implementations. • The quality is high because they test reputation and the ability to deliver and implement of the vendor. • The selection process should link the desired outcomes with the system features, and prove that link with a quantifiable process. <p>Implementation success</p> <ul style="list-style-type: none"> • The implementation was challenging because of last minute changes. • The iterative process was one of the main success factors as it allowed for testing the systems many times before going live. • The implementation was successful because of a large IT department. • IT staff with a rich varied background. • Subject matter experts are brought when needed. • Supplier management and relations are key for project success. • Vendors are treated as strategic partners and involved in the project process and meetings. • Maintaining a good relation with the vendor is important; any mistrust will cause the project to fail. • The quality is high because it's based on the requirements and outcomes. • End users are involved in the implementation phase especially to provide and verify requirements verses system features. • The vendor listens and takes feedback about features and adjusts the implementation accordingly. • There was good communication with the vendor; project delays and changes in plans are communicated in advance. • Super users play the role of connecting their peers with the system providers and structure the feedback. 	<ul style="list-style-type: none"> • The clinical team briefed the IT team on their requirements. • It was a result of clinician's feedback and interacting with the vendor to get the actual requirements from the system.

4.3.2.1 Vision and business plan

The eHealth implementation at GJNH has a vision and a business plan based on the Scottish national eHealth strategy: "There was a national directive to say that the vision of

the government is for all organisations to be using clinical portal, and then to connect through portal-to-portal connectivity” (EP1). This national vision cascades down to regions and facilities: “There has been absolutely a vision, a strategy, and a plan to help our working facility locally, but that also played along with the national vision as well,” noted CU2. Another clinical user agreed saying: “The Scottish government targets, plans, and also implements national systems that we need to connect to” (CU4). EP3 clarified further: “We took guidance from the Scottish government. We developed our own strategy plans, but it’s under advice from the Scottish government.”

Based on the national vision, a local delivery plan was developed as EP3 added: “... we sat and developed a rollout plan, and how do we get all the users into the system.” The local delivery plan, in essence, formed the business plan: “The business plan, essentially, is the local delivery plan. So that’s our version of eHealth strategy, and that says what we will do to deliver eHealth” (EP5). The local business plan was approved by the board, and aligns with the national strategy: “The vision aligns with the board vision where we want to lead on innovation, high quality care, and research. So everything in the eHealth strategy aligns to our board’s strategy” (MM6).

The alignment between the national vision and the local plan has resonated well within the clinical community. CU9 shared her related experience: “As a member of the clinical portal, I know that it was part of the eHealth business plan,” which she goes on to say it “does seem to be hitting the mark as a way of things to come. ... So, I would say that the business plan, in my mind, seems to be quite solid.” CU9 also highlighted the importance of linking things together both locally and nationally:

I think there is an effort to bring everything and to streamline things within one system. I think that’s part of what we do because we do have other systems around the country that we’re trying to access. By bringing all those systems into our system, I think there are benefits, there. (CU9)

Such alignment was achieved through targeted, yet easily accessible communications, again, according to CU9: “Even if you haven’t seen the whole business plan for the whole of the hospital, you’re kept up-to-date of what’s happening and where it’s

happening.”

Clearly, planning and alignment was achieved not without any issues or difficulties.

According to some of the clinical users, the strategy lacked an enforcement mechanism, and was put together by a group of people at the management level that are far from the actual service delivery at the hospital level:

There were two downsides to it; one that it was a strategy without teeth, so the progress was slow and management was an issue, and the other slight problem with it is having that big strategy from people who are from where they are in the working environment. It could have been rigged. (CU2)

As such, according to CU2, some scepticism was evident with regards to the vision and business plan.

4.3.2.2 Enterprise communication

The communication plan around the eHealth implementation started early, by engaging different groups at the hospital. EP1 explained: “... we asked if we can give a demonstration of the system to senior management team. I then started going around all the various medical staff meetings.” Other means of communication have been improved because of the eHealth portal: “We have a weekly bulletin from communications and I use that regularly to update and say we’re doing this with portal ... and we have a newsletter that goes out quarterly....” (EP1). Communication was particularly important to inform potential users who are not yet involved in the project, which CU8 explained, noting, “There’s certainly information given through bulletins to inform other staff members that there are changes and why those changes are being made.”

Communication around the project was varied as MM6 clarified: “It’s formal and informal but mostly informal. But the majority of that is also done on informal basis because the leadership principle here is that we expect everybody to be highly visible out there in the clinical areas.” On the formal side, specific groups were set up: “that report back on the project and present it in the next user group meeting” (CU2). Those user groups were set up

per specialty as explained by CU9: “What they actually do is to set up user groups from everything: anaesthesia, orthopaedics, some of the secretaries from a mixture of places, some of the nurses. There’s someone there from all the different disciplines.” Such formal communication plans would be part of the implementation plan as CU4 mentioned: “We had a strategic plan and a project plan in terms of implementation of software and that included plans to inform people that it was coming.” Under this setup, the communication is specific to certain aspects of the project:

Each communication plan tends to be tied to each of the aspects within the delivery plan. So, for example, if we were going to be rolling out electronic prescribing, we would get all the stakeholders around that. We would also make sure that there are stakeholders involved to help others in using the system. (EP5)

Compiling feedback is part of the communication plan as CU9 noted: “Compiling of feedback and monitoring progress and how it fits the business plan” is part of the more formal feedback, whereas the rest of the communication is not as formal. For example, EP3 mentions, “We do our own kind of internal press releases through various magazines and newsletters, emails, announcements in places like the canteen where staff is passing by. And we email users when changes are coming up.”

Team leaders were involved in communicating with their peers as MM7 mentioned that they had “a qualified team lead as well, who’s one of our consultants, and that helps net the clinicians together around eHealth.” EP5 made it clear that he wants eHealth to be a shared interest and obligation of the organisation, regardless of the formal responsibilities by “making sure that everybody realises that eHealth is everyone’s business rather than ‘my’ business. We also tend to have comms using the organisations ... to keep everyone updated.” Such an informal approach also includes direct unplanned visits to users if required, according to the proactive EP5:

If I had people who are not using it I would literally knock on their door and say ‘Hello! You need to be using the clinical portal, give me 5 minutes of your time and I will show you what it can do.’ I would do one-to-one training ... and I would grab staff as they’re passing. (EP5)

However, some team members, like EP3, thought that communication standards were missing: “We don’t currently have [formal communication methods] but I think it’s something that we need to address. If we had a standard that each project adheres to it would be beneficial.” On the other hand, CU2 thought that internal communication was sufficient: “People that are involved in that on committees or user groups had a good line of communications between themselves.” However, communication from the project team to the rest of the organisation and the user community was poor, or at least not at the same level, according to CU2 who noted “delays in communication from the eHealth department out,” and then elaborated mentioning:

There have been delays. Things were less than perfect, less than ideal than things disseminating from those project teams to the end users whose information communication hasn’t always been the best, but as I said, that’s because we don’t have very good lines of communication from top to bottom across all organisations. (CU2)

Finally, communications were not only internal within GJNH, but with external entities like other hospitals, partners, and vendors, externally, as well. CU9 shared, “I am also part of a group that they have where I go meet other users from other health boards so we can bounce off of each other what kinds of issues they have that we haven’t got yet, but we might have tomorrow.”

4.3.2.3 Change management

GJNH tried “not to have a fixed single approach to anything or a fixed single tool for change” (MM6) and applied different methods to manage change around the eHealth implementation. However, EP5 thought that there was no formal change management function, rather informal trade-offs between the eHealth team and the clinical team around the required scope and what can be achieved with the available budget:

... There isn’t much formal change management that goes on, but we make sure that the project group is regularly sat around the table. We make sure that everybody is briefed on the risks and the issues of the project, and we make changes, trade-offs based on how much funding we have for the bit of work, and the group makes consensus deciding, on their own, what the priorities are. (EP5)

Continuing on, EP5 notes, “So that’s how the change management works” within GJNH. On the other hand, some clinical users observed a clear process as CU9 described: “What they do is they tell us first of all, well in advance, so it goes through an electronic medium to everybody, whether if it’s going to affect you or not.” Thus, initially, there is general communication to all users. The next step is to have specific discussions with people related to the system implemented, which CU9 explains: “... there’s pretty much a pattern having discussions with ... the people more related to the system.” The following step is then guidance on the system for all users: “They also organise training sessions. They have a very good way of doing it. You’re kept up-to-date about it” (CU9).

As part of change management, different strategies and techniques were used. Before the general implementation of a system, a pilot implementation was done in one department or with a certain group of users as EP3 explained: “One of the first things we decided was to pilot it, and we decided to go ahead with the pilot within the orthopaedic departments, and that happened very quickly.” In that particular case, the pilot was a success. Such success encourages more team members to use the system as CU9 reminisces of having “... had people banging my door down asking for access to portal.” CU9 also confirmed the benefits of pilots, asserting that he thinks they are “very useful to help you get a feel for [something]. So if something is not thought about, while you’re physically doing it, something jumps out at you, so again we can make changes.”

The iterative implementation approach was another factor that contributed to change management as it allowed users to participate in change: “We have tried to create projects that are agile, and that also have an iterative approach, and each iteration, the users are allowed to go in and see developments and play with the system so get better familiarity, and they also can raise questions” (EP5). Engagement with users is an effective change management tool: “What the clinical team want from the system, and what the management team need from it, and how can we both get that well out of the system” (MM6). Such engagement is essential for eHealth and other initiatives in the hospital. MM6 added:

You can forget doing anything unless you do that right from the start.... You know it's not 'management say' is what everyone must do. We actually agree together as a team when we want to progress any service development, eHealth or otherwise. (MM6)

CU8 confirmed that view from the clinicians' side as well noting that they:
... Get early information about the changes that are going to be made, and early involvement in what changes we would like to see as well. So I think that's a part of the change process, certainly allowed us to feel involved. That can only be a good thing I guess. (CU8)

To achieve the required engagement of clinical staff, specific clinicians were selected and asked to join the project team as explained by EP5:

When selecting those people you tend to go for someone who's senior in the area, and who would be able to influence their colleagues. So the colleagues think that if he thinks it's a good idea then it must be a good idea. So I suppose you're kind of doing it informally when you're putting together the project group. (EP5)

Management sees those clinicians that act as role models for others as champions, and has a very clear vision of their role as MM6 elaborates:

We really do focus on finding ... the clinical champions. They may not know what the answer to the problem is, but they're enthusiastic to help drive that vision of change forward. Where they're trying to frame projects in their language, you know, user-friendly presentations to deliver an improved outcome to the service and their patients, not on the finance or the technical aspects, or what management wants out of it. (MM6)

This way the eHealth team and clinical team would work together on change management and solving any issues: "I think if we get any opposition, it will be myself and representative clinicians standing hand-in-hand trying to do the right thing as opposed to just me or my staff" (MM6).

Internal politics affect change management as well, but the intention to bring resistant departments on board with eHealth is evident: “The only areas that are not using it are radiology and theatres and that’s kind of ... political. However they are on my radar and they will not escape,” quipped EP1. The age of clinicians meant to use the system affects their likelihood of adopting it and embracing change as well, according to CU4, who said, “It is easier, nowadays, to implement a new system than it used be in the earlier days because all the youngsters that come in are all trained in the IT systems, so they’re much more computer literate, and they expect it.” Thus, in this experience, younger users are more likely to adopt the new IT eHealth system than older users.

Additionally, communication is essential in managing change. EP3 attests, “We do offer various types of SharePoint sites to provide feedback. We try to get people as much notice of change coming. We also try to basically hold their hand, and guide them through the change.” An important part of communications is to convey the end goals of implementing the system: “Right at the beginning we do that, and we go out to the wider staff and communicate well, so we give them regular updates on the project status, where we are at that point of time, and what we expect to be in the outcomes” (MM6).

When success is achieved, it has to be celebrated to encourage the implementation team and users to continue working on that successful strategy, and solidify the change. MM6 qualifies this claim indicating:

We usually try to use some kind of formal conclusion, you know, where we invite people to celebrate the delivery of that project, and that change, and try to get some kind of recognition to the work of people putting time and commitment into our project. We invite the chairman of the board, the local politicians, or someone to come in and just recognise this has been a huge project, and it’s successfully implemented, you know, to get that recognition. (MM6)

4.3.2.4 Project management

Project management was an effective function of the eHealth implementation at GJNH. It has been strategic and dynamic, as CU2 stated: “I think it was a very good function. It was set up strategically. Part of what has gone well is that it’s been dynamic; it involved

users, and that was part of how the work was done.” The project management group was effective because of its team and environment:

I think it has been laid well ... and I think one reason is that he has picked the right individuals, and created a nice atmosphere around them. It’s interesting when you think about it from a managerial leadership style; what he hasn’t done is to crack the whip. All he’s done is to engage and become involved, and listened. (CU2)

CU8 seemed to agree with this perspective: “I think project management is required, absolutely, to insure that staff has access systems that are relevant to their needs and then to create ways to use that with on-going support, so yes absolutely important.”

Technical methodologies and tools were used to enhance the project management function:

We basically used the methodology of Prince 2 just to add some structure. So we went through the start all the way to the close stage according to it. We used it also in talking with the external supplier. We also set up a SharePoint site for the project teams; they can see the tasks they were allocated. (EP3)

Those tools and frameworks were used to collect feedback, track progress, and update on upcoming tasks:

We have a process of regular feedback. One we use, SharePoint, so everyone has access to previous meetings, acceptance notes, etcetera. It has a log that shows access to the system. We also have regular meetings both as the steering group, so we have a steering group for the development of the software. We also have a user group, which is much wider, so people can come in a give their feedback on the progress forward in terms of software developments. (CU4)

Moving along, the process of input and feedback was organised through an agile implementation approach. According to CU4, this was done:

... Through a process whereby requirements were documented, then they were presented to the project team for approval. Once those were approved, developments would start on that particular part of the project. We then go back to

the project for testing. They would give us feedback from that; then there would be a second round of testing, and that would continue until all testing has become to a level that can be accepted. (CU4)

Using such an approach meant that certain skills had to be available within the team, and certain rules and guidelines had to be followed in project tracking and reporting, as EP5 explained:

I had to make sure that everyone in the organisation had at least done Prince 2 foundation, and for some of the senior staff, have done the practitioner as well. We're trying to stress the importance of having to create a project initiation document, and having a project plan and reports in place. Once you have everybody speaking to the same currency, it then becomes easier for the project manager to speak to the team and see what are you doing to the plan, and when you get everybody on the same page in that respect, it's a lot easier. (EP5)

The level of formality in the project team structure is related to the type and size of the project as MM6 explained: "We tend to use Prince 2 methodology for the majority of our projects. Depending on the project, the scope, and the size and the type of project, we do have formal project management for all major developments." However, that does not mean that the flow of information has to be in one direction according to the process, as CU2 explained: "There has to be a balance. Sometimes, too, you have to take decisions, but decisions should not be completely and utterly autonomous; they should be decisions that have been at least influenced by previous meetings and discussions with staff." To collaborate with this view, CU9 experienced this same approach. She described the project manager on the system she used saying, "She tended to be very hands on. She would come along and we would basically look at it, and then they tell you, right, you know, we can do this, and she would put it on a piece of paper." She added, "the project manager also takes the role of communicating to the management, to IT, and to external entities" (CU9).

4.3.2.5 Implementation team structure

As MM6 explained, no set formula is used in the implementation team structure, which is instead kept flexible to meet the needs of individual ventures and desired results:

We design each project team around the project and the expected outcome rather than having standard formulas around team design. For example, we have GPs involved if the scope of it was around emergency care who can reach out to the community. So we try to look at the outcomes we expect from the project, and look at what the project member should be. (MM6)

At the same time, the teams would primarily include “physicians, nurses, physiotherapists, the technical scientific side. There’s a minimum requirement of a doctor and other clinical professionals, and managerial, as well as the senior eHealth with financial input, HR input, and communications input” (MM7). EP3 shared his team experience as well:

There were clinicians, consultants from each specialty. They were also backed up by members of the information systems team. They also had representation because of the kind of product, so it’s not only representation to enter data to the systems, but there were information teams because the most important thing is the data coming out at the back end. (EP3)

Connecting to the teamwork, at project initiations, initial plans are shared with the steering committee and stakeholder representatives to get their approval:

We carefully chose that stakeholder group and that consisted of: consultant orthopaedic surgeon consultant heart surgeon. We have a consultant anaesthetist, a medical director; we have secretaries, administration staff, medical record staff, nurses; we had a very, very wide range. So we went back to them and said: ‘What do you think? Do you want to go with this or do you want to wait till we have a few more systems integrated?’ And the overwhelming outcome of this was: ‘We need this now!’ (EP1)

CU2 had a similar understanding of the project team structure:

I think they have that department on the staffing level where they are working from the overall organisational goals. Then you have teams in the IT department that have project team leads, project workers, then there are workers within different specific fields, where they know what’s technically involved in the project, and there are people working with the back end and servers.

He clarified that the task of being a representative in the project team is harder when it comes to clinicians:

It's often more difficult for clinicians to have such variety in specialties and various people to represent. It's really difficult for them to tell 'what do clinicians want'; that's the hardest question because ... how can I as a clinician represent, not only my specialty, but all specialties from bottom to top in seniority? Then they're looking at certain governance going into pharmacy, physiotherapy; there's hundreds of different staff members. I can't tell you what they think. (CU2)

Nevertheless, involvement of the clinical team makes it a clinical project not an eHealth project as:

The project team has to coordinate between the three teams, the three clinicians representing their specialties. They were tasked with insuring that the requirements would fit the purposes of their colleagues; they took sole ownership and it was stressed to them throughout the project that they took ownership of it. It wasn't an eHealth product. It was a clinical product. (EP3)

He added that working with clinicians requires the eHealth team to influence the clinical team, which they did through reaching out directly to each clinician: "We would have to have individual meetings with each of the representatives, and talk about their requirements, and try to work out how to reach them"(EP3). At the end of the day, team selection is not only about the tasks that the team members would deliver, but also how the team members would communicate to their respective members: "It's not just meeting in general. What they're looking at is the bigger picture, and who's going to impact. So they've got people on board to kind of assist with the message," said CU9.

It was clear from the interviews that the engagement of clinicians in the eHealth implementation was essential. It developed into a partnership between the clinicians and the rest of the organisation as EP5 explained:

Clinical involvement is absolutely important. Clinicians are changing as well, and also their culture and beliefs, I think. Typically in the past, you would probably think while

dealing with a senior consultant that they're the main person in the room. And now it's more of teamwork when multidisciplinary teams are involved. (EP5)

Clinical involvement starts from idea generation all the way to the conclusion of the project, and includes all specialties. CU8 suggested "... to involve, as early as possible, in the early stages is good because we can ask for certain things to be included in the project, or tell the eHealth team which parts of the system aren't really useful or necessary." CU9 went on to say, "They had meetings with other clinicians, so that would be anaesthesia was there, cardiology, orthopaedic, everyone who would be using this, just to find out what they thought. What their requirements were, where their concerns were."

As this partnership got stronger throughout the project, clinicians viewed eHealth as a shared responsibility: "Since we got well underway in the process, they see it as much as their responsibility as my responsibility," noted EP5. Clinicians' responsibilities included instruction as well:

Training worked to several levels. We had to train people who are administrators of the software; we had to train end-users, which is really different. Again, it was different according to which part of the system you're using. If you're a centric surgeon, it's different from a cardiologist. (CU4)

They designed the system by requesting what needed to be included and how the outputs should be displayed. CU8 clarified:

We're involved in requesting what tests within the clinic setting preoperative, and we provide the eHealth team with feedback on certain bloods, and other similar areas they need my feedback on. So we're involved in the actual building of the system. (CU8)

The iterative development methodology resulted in clinicians' satisfaction as they were part of the process, and organised clinicians' involvement within the delivery plan:

We kind of exposed them to iterative development methodology, which I think is important, as well, in delivering IT in a healthcare environment because clinicians will never be patient enough to wait till the full system specification is built. They

would rather work in an iterative development process, where they do workshops on regular bases to decide what should the system look like. They will also see them being built and evolved and that is what keeps them engaged and interested. (EP5)

4.3.2.6 System selection and implementation

The system selection process at GJNH starts with gathering the requirements of the users as CU4 explained: "...the technical process by IT started after they understood the requirement and what they're in for. Clinical requirements are the main focus when making the selection." Instead of searching for certain features in the system, clinical outcomes were addressed first when they "... decide what the clinical outcome we would like to achieve, and how we would like to get there, and how would it look with the vision. Then we look for a system with the technical specs" (MM6). After the requirements are identified, the eHealth department writes the specifications. Then they go through the system selection process set by NHS Scotland: "For the system selection we were using an IT NHS Scotland framework. Various suppliers signed up to the framework and we just sent out our tender to those identified by the framework to supply their answers" (EP3). This process is strict and robust as MM6 explained:

It's monitored by our government's committee and our financial committee, not only on how we both tender and procure, but also on how to *operationalise* it, and get the benefit realised from the contract. So that's also done by a team, so it's not just eHealth, and finance; it's a team with the clinicians there. If I am not involved, it will be one of my executive directors on my behalf. (MM6)

The selection process should link the desired outcomes with the system features, and prove that link in a quantifiable and accountable fashion. MM6 went into the details:

We actually measure the system we're buying against the outputs we have agreed, and we very often weigh the outputs so they're not equal because clearly no system comes fully singing and dancing with everything. So, we weight them of importance and we even have a quite detailed discussion on the weights: what a weight of importance means, is it important for the patient, to the management, to the eHealth group, to the clinicians, and we agree weight for that particular outcome. And therefore, we score them, score all the systems, and individual components, and

then multiply that by the weight, and we do that for our patient benefit, clinical outcomes, and a financial benefit. And it's the same criteria that we apply across all our projects. It's a very strict and quantifiable process we use, and transparent, so if you're going to say, 'why did you decide on that product?', we have an absolute detailed measure of how we reached that decision. (MM6)

However clinical users, like CU9, think that the system selection is a responsibility of the management, not the users:

We would come in when ... when the eHealth team and the management team have gone out and done the homework. They just don't decide on just what the system does. I think they look at the options on a wider scale before deciding, and how things are working, are they working well, before they get into it. (CU9)

When making the selection, an important success factor emerges, which is the relation with the selected vendor. This relation is essential, according to EP1, who attests, "when you're doing a selection, it definitely has an impact on the project and you have to maintain a good relationship with the vendor. If you don't have that, your project will flounder." EP5 agrees and believes that vendors are partners:

We in Scotland, in general, deal with vendors as strategic partners. And you keep yourself close to where their concerns are so there are no surprises. I think supplier engagement and supplier management are key assets of delivering high quality eHealth solutions. It's better if you get an environment in place when they tell you what's worrying them, and the same time you get to tell them what's worrying you. (EP5)

He also hosts purveyors in the internal meetings: "Within the project board, you would have a vendor representative in the ... regular team meetings ..., so you interface their organisation into the process so there are no surprises" (EP5).

Another advantage with the implantation was the large eHealth team with diverse experiences: "One of the advantages is that we have quite a large IT department, so in that there are a number of individuals who had expertise on various parts" (CU2). According to

him, communication also plays a role in the implementation: “I think if you’ve got a reasonable system, as comms get worse, the system will fail. As comms get better, the system would be adopted better” (CU2). As a result, that implementation was reasonable and met clinicians’ needs, as CU8 stated:

Certainly, what we currently have meets our needs. As far as I can tell there are no other systems available that are superior, so I guess in that respect, the systems that we have meet our requirements. They also appear to be the leading edge of what’s possible within the current resources. (CU8)

However, achieving such a result was not easy, but the iterative approach was another positive point:

When it comes to the implementation, ... ‘Go live’ day went fine; we didn’t have too many problems, but that was because of the iterative approach that we took. So the systems had been tested very much ... before we actually went live. (EP3)

4.3.3 Themes that emerged from the case study

This section will go through a list of themes and success factors that emerged in the case study interviews that neither fall directly under the D&M success model, nor the success factors summarised by Abdullah (2012). However, users raised these issues when answering questions related to the two identified areas. Some of those themes were discussed in the literature review, and some were not. But in both cases, the case study findings helped highlight those areas and added depth to the understanding of their part in the implementation of the eHealth initiative at GJNH.

4.3.3.1 Clinical involvement

Clinical involvement was mentioned in the answers of almost every interviewee in response to different questions. It is not a new theme in the literature and was addressed repeatedly, but a construct specific to the implementation of eHealth in contrast with other information system implementations. Clinical involvement was mentioned in relation to other themes and constructs like implementation team structure, change management, training, and success factors. Some of the respondents focused on having a supportive clinical leadership. CU2 thinks that it is certainly required:

Absolutely! If you don't involve clinicians, it will fail. And the reason I say that is: these information systems that you're developing for what? Imagine information systems that are only purely administrative at a hospital setting. Even what you see as administrative, all you see at a hospital has to do with two main groups: one is the patients and the other is the staff. The mass majority of staff is clinicians, so if that implementation was for an HR system, I think that you still have to listen to clinicians because the clinicians make up the majority of that system, and they are in fact going to be users of your HR system. (CU2)

Clinical involvement was viewed as being essential for change management as well. Its importance is about system use and adoption by clinicians working with other clinicians to use the system, and in the changing process and features that affect the daily duties of clinicians, as CU8 mentioned:

The process is about involvement in those projects. We get early information about the changes that are going to be made, and early involvement in what changes we would like to see as well. So, I think that's a part of the change process, certainly allowed us to feel involved. That can only be a good thing, I guess. If there is no involvement at that early stage then, there might be reluctance to use the new system if that doesn't happen. So I think, certainly, in that respect, change is well managed. (CU8)

4.3.3.2 Innovation in training

CU2 thinks that user interfaces are very important when it comes to eHealth systems. eHealth systems should have effective and easy-to-navigate user interfaces. If they achieve that, eHealth systems would not require training, which would eliminate major issues like resistance to using the system. According to CU2, eHealth systems should be as intuitive and user friendly as an Apple application, for example. The applications are so user friendly that they can be used by a five-year-old child: "Apple can give a device with one button on it to five years olds who have never seen this thing before and they can navigate it. Even though they've never been trained." In summary, eHealth systems should be user friendly and intuitive to the point that they should require no training, which CU2, our critical champion, was not shy to assert: "So companies should focus on user interface and I

think the focus should be that it should require no training.”

CU2 shared his own training experience, or in fact, his experience of no training for a system they developed within the hospital:

I am not sure if I showed you the app for EMRS; it's a multifunctional app that covers a whole variety of different contexts of information and all users have no idea how it's updated in the back end. They know nothing about that; they've been using it for four years now and we have never ever, ever, ever trained anyone. (CU2)

This EMRS application was built based on feedback from clinicians. It is so user friendly that it looks like an iPhone application. Therefore, no training was requested nor given: “.... If you opened it up and used it, you would immediately say this is an iPhone App. It just works as an iPhone app, so because of that, no one has ever been trained; no one requested training on it” (CU2).

CU2 talked about a new way of training in eHealth through a “Social Training Framework”, where experts teach other users through direct interaction, using electronic forums. Social networks and how they can be useful to promote system adoption were mentioned in the implementation literature under leadership. In this context, those networks are referred to in a similar manner, while stressing on the role they can play in system training. Such training methods can make system training more exciting and relevant. In such networks, experts teach each other informally, and learning becomes an interesting and exciting exercise:

... A few people know and then they tell other people about it. It's an informal social network of teaching. Experts teach each other ... If you and I were standing with our iPhones and I tell you, 'Have you seen how to do this?' and you say, 'No, I didn't know', and I show you and say, 'Isn't that really cool?', you're really excited that you learnt a new thing, and I feel quite proud that I showed you. (CU2)

Such networks can help in making up for issues in project teams, and the inability to represent all clinicians. The project team can use different channels of communications, social media, and presentation to staff to get their feedback. Then this feedback should be

taken on board as CU2 explained earlier.

4.3.3.3 Satisfaction and benefits

The case shows that in eHealth, satisfaction and benefits could be independent. That could be a major observation or a turning point. CU2 was one of the main critics of the system. He explained the weaknesses of the system, and his dissatisfaction with its use:

Is it currently a system I would like to use? No! It's fragmented. It's slow. It includes two user interfaces, and it requires multiple logins. When I say it's fragmented, what I mean by that is that there are some bits information there, but not all bits of information, and obviously what I mean is that there are some that are not available through electronic format, full stop, end of story. (CU2)

Regardless, he thinks that the system is beneficial because it makes patient information available at any time or from any location, in addition to other benefits:

... It's useful because there is an increasing ability to find information on a remote basis. So, in the past, if I wanted to know something about a patient, I had two options: I either went to that patient's notes on the ward or I went to the records department and got the notes, or I could potentially, depending if it's a lab result, test result, I could phone that department. So there were a lot of phone calls, and there's a process to do that so you could be mixing patients up. (CU2)

4.3.3.4 Organisational culture

The eHealth philosophy at GJNH is all patient-centric care. EP5 stated: "We're always trying to put in place systems that support patient care most and foremost." Such a philosophy aligns with the organisation's vision and focuses the institution's effort around eHealth as an organisational strategic initiative. At the same time, there seems to be a sensitivity of what was perceived to be bottom up and iterative by one part of the organisation, which was mostly management, and another, which was mostly the clinical team. CU2 highlighted that view:

Sometimes, too, you have to take decisions, but decisions should not be completely and utterly autonomous; they should be decisions that have been at least influenced by previous meetings and discussions with staff. There needs to be a recognition that

the top down is not going to have all the answers; the top is going to ask the bottom what they need and what they want. So, I think it's the way of doing it. (CU2)

Another area of contrast seems to be the contrast around communications related to the eHealth project. Project managers and IT think that it is beneficial, while some doctors think it is detrimental. Despite some discomfort, CU2 explained:

That's going to be an embarrassing answer, but I will stick to it, and it's really unfair on eHealth to be honest, because we're using the same standard type of formal communication that we use in the hospital across all departments being from management down to other departments, and in general terms across, not only our hospital, but everywhere I went across the west of Scotland is poor. The dissemination of information is poor. (CU2)

On the positive side, the organisational culture contributed to the success of eHealth. Involvement of all groups of staff, and the informal approach adopted by management, helps in eHealth success and progress. MM6 explained the management approach:

Myself and all the executive directors, we actively become involved. We do that with everything. We are not remote from things that are happening so we become very active in what we're involved in. ... we have a very informal way of working here; my doors are open all time, and if [someone] is passing, he'll pop in and give me an update on something. You know, it's not a formalised way of working. (MM6)

This organisational commitment to health advancement and patient care, and the acknowledgment of the importance of eHealth transcended throughout the organisation. To many of the users at GJNH, eHealth is the way forward in healthcare; there is no going back. CU9 summarised this view nicely:

We need it because ... Electronic communication is the way of the world. I mean paper records, to me, sometimes can get lost; bits can fall out of them, or things will fall on them. To me everything we're doing here is kind of moving in the right direction ... we have got opportunities, a lot of different stops to basically give your thoughts on it and to make a difference with it. (CU9)

4.3.3.5 Critical champion

Champions of change became a common term related to change management, and helping organisations through major changes in processes or systems (Lorenzi et al. 2009, p. 15). The role of champions came up in a different part of the case study. However, another variation of change champions emerged from the case study, which is the critical champion. It was apparent in a number of sections above that CU2 was very critical of the system and the eHealth implementation. He made it clear that he was not satisfied with the system and that it was not, in his opinion, user friendly, nor is it used by many at GJNH. Regardless, CU2 thinks that the system is beneficial; he listed its benefits at different occasions. He suggested and worked on many initiatives like iterative development, change management, and innovative training methods. He does not have a specific solution to make everything perfect, but he is determined to work on it, although he recognises that the bottom up approach is quite complex: “I think everyone is trying to answer this question but there isn’t one. I think you have to try a variety of things to find answers to how it may work. It is quite important to make yourself known and visible” (CU2).

The leadership at GJNH is very serious about the role of change champions to the point that they actually structured training to prepare change champions for various projects and initiatives. MM6 explained that initiative:

We also have a change champion training on an annual bases, so we do have a lot of special projects, but we identify people that have that potential to become change champions, and we put them through our training program every year so they’re ready. When we do have a project coming up, we can call on them. (MM6)

4.3.3.6 The national aspect of eHealth implementations

GJNH operates as part of the NHS of Scotland. The NHS in Scotland follows a “culture of convergence” in their eHealth strategy and delivery of care, in general. It is a “lose-tight” strategy when hospitals and trusts are not told what to do, but are expected to accomplish similar things. EP5 explained:

Within Scotland we have a set of national standards and it’s a culture of convergence, essentially ... each of us having to make their own local decisions on

what we're spending our money on and so on. The framework that they try to set you out against is introducing a number of national standards that they produce. (EP5)

EP5 explained that to achieve an eHealth strategy, freedom is given to boards to deliver around the strategic outcomes, so people that are close to the business make investment decisions. He added:

... They produced the high level, and then they say to you, as the set of organisations, 'We can't have 22 varieties of systems,' so you go among yourselves through a connecting platform or a working group, and as a result, people went with it. So, there's a framework from high level strategies in terms of architecture and design. (EP5)

Boards write a delivery plan based on their local interpretations of strategic aims, and what they will deliver. To support different organisations within the NHS, they founded a central architecture and design group, which produces design documents for different solutions: "There's a central architecture and design group within NHS Scotland, and they produce design documents. The government also expects your collaboration" (EP5). There is also an eHealth national group, made of eHealth board heads, which meets monthly to discuss all health related issues, and the implementation of national strategy: "You've got the heads of eHealth groups, so every person in my role get together on a monthly basis, so we lock ourselves away for the whole day and we have an agenda, talking about everything" (EP5). In addition to this, the national clinical group, which provides guidance on systems' content collaborates. Those two groups work together collaboratively with clinicians and eHealth leaders:

The two groups work together closely and they have joint meetings of clinicians and eHealth leaders locally. The managers of eHealth would meet locally to tie it to their local organisation's objectives, but equally senior clinicians will have an eye on what's happening locally and how to adopt the system across the changing process and priorities. (EP5)

The management group has a similar view about the national aspect of

implementing and using eHealth. Their strategy was partly due to the necessity of connecting different regions:

I think it's a general thing here in Scotland. ... we're far ahead in terms of usage and implementation of eHealth, and part of it is because we have to. Because of our status, we have to connect to boards and patients all the way from the Shetlands in the North down to the borders of England. (MM6)

She elaborated on that strict-loose arrangement where guidance is provided, but freedom of application is granted to achieve success:

The Scottish government, a few years back, moved from being centrally driven, 'you must do this' approach, and it took a lot of effort by the boards to persuade them that is not the way to make this a success. That's the way England went and look what happened. You just have to support the boards building their eHealth implementation strategies, under, clearly, the framework of Scotland, but you have to trust and support the way we deliver the best possible strategy and connect to other boards while we do that. (MM6)

This same sentiment was well summarised by EP5:

There's a ton of conversions in terms of the delivery of health in Scotland. So our view is that we have a set of similar problems, and a set of similar outcomes, so let's get together and find a set of best of breed systems that could help us all. (MM6)

4.3.3.6 Strategic outcomes

While planning and implementing eHealth at GJNH, it was important to link targets and KPIs expected from the system with actual patients' outcomes. It was not about achieving certain numbers to show improvement, but about real improvements in patients' results. MM6 explained:

They were hitting the targets and missing the point. So they had data to show that KPIs we delivered, but what they didn't show is that elderly people were lying in corridors and dying with pressure ulcers, infections, and dreadful quality of care. They addressed the targets because they were improving that, but they didn't link it to the quality of the patient care and the outcomes for those patients. For us, that's

critical that they need to link together; you can't keep targets in isolation from the overarching patients' outcomes. (MM6)

All the desired outcomes and initiatives taken under eHealth are focused on achieving three main strategic objectives of the organisation, which have to be accounted for in any decision around processes and systems:

We have around three specific areas that we make sure we always cover for any performance management scrutiny or any business plan and strategy we develop. And it's based around three words: Safe, Effective, and Patient Centred. So everything we do whether it is performance management, we ask the question 'Is this service safe?' So we look at complaints, incidents, falls, infections, etcetera. We then ask: 'Is it effective?' So we look if it's financially effective, is it clinically effective, so does it comply with all the latest research, is it evidence based, and then we ask is it patient centred, so do we get patients' satisfaction, do we cater for relatives and carers, and do we have links out into discharge into the community. (MM6)

The technical application of the outcomes orientation of the organisation is data frameworks. MM7 explained that they do not want to have different data frameworks that could look good at only one department or one level of the organisation, but a multi-level data framework that could show the required data relative to other indicators in the organisation to get a real view of improvements: "... we do not have different frameworks for each level information, and we want to choose one framework between different frameworks that we need to use at different levels of the organisation" (MM7).

4.3.3.7 eHealth leadership

It was clear from the different interviews that the leadership of the eHealth department and the quality of its leader are essential. MM6 points out:

We specifically appointed him through our really robust process, looking for someone who can bring that technical expertise, but to relate to clinicians, to doctors, to nurses, to theatres teams, and to talk about eHealth in alignments in terms of the benefits to their patients, to their service work. It's fundamental; I think

you can't do without it. So I think we have one of the best eHealth departments I have ever seen. (MM6)

The head of eHealth is focused on availing the merits of eHealth, which is also explained by MM6: “[The head] is absolutely focused on getting value, some operational value, for clinicians, and also for managers as well. In terms of the IT function underpinning what people do in different functions and help them to do it better” (MM6). The eHealth leader is trusted and participates in initiatives outside eHealth. He sat on nursing and management teams, and participated in board meetings. MM6 added:

I think because of the nature of who [the leader] is, and how he operates with his team, and how he believes that role should operate, for example, we have clinical department ask for [him] to go and work with them rather than waiting for us to ask them to work with him. We also asked [the leader] to take the lead in projects that have nothing to do with eHealth because he has established such great credibility with the clinical teams. (MM6)

Related to eHealth leadership, as expressed by CU4 earlier in the success factors, a satisfied and happy IT team member is one of the success factors of the eHealth implementation:

I think there's a happy atmosphere down in the IT departments. They seem to be enjoying the job; they seem to be well looked after and respected, and I think that like any others, being well liked and well respected, you tend to perform better. The health of the IT department, I think, is very good. (CU4)

Professional background of the eHealth team is another interesting factor that came up in the interviews. The clinical background of eHealth personnel is an advantage as per EP1's perspective:

It's not always easy for clinical people to walk out of their ward ... for 30 minutes or an hour to have training, and it was much easier for me to go to them. I also had an advantage because I am a nurse. (EP1)

4.4 Summary

In this case study, a set of interviews with executives and senior managers, clinical leaders, and administration personnel at GJNH demonstrated that there is a high level of applicability of the D&M IS implementation success model in the eHealth implementation domain. The results, established earlier in this chapter, indicated that all themes of D&M apply to the eHealth implementation at GJNH. It also shows that there are other eHealth specific constructs of each, like; helping clinicians to be more productive, cutting down waiting times, making patient information available at any time from any device, and the quality of clinical data that allows clinicians to view it with less time and according to the structure they prefer.

There were also specific eHealth success factors like clinical involvement, the quality and background of the eHealth team, and the alignment between the objectives of the implementation and hospital's strategic objectives of being more patient-centric, more efficient, and more precise on service delivery. Those themes and success factors are related to the healthcare context, like the wide range of stakeholders involved and the complexity of healthcare service delivery.

However, the perception of the implementation success and its benefits can differ according to different individuals involved in the implementation. That perception can be different in terms of making a distinction between an eHealth implementation success and whether, or not, that implementation is beneficial to the organisation. Such a distinction can be different from the D&M model (Delone, 2003) in terms of some individuals viewing the implementation as beneficial, but not necessarily successful.

In the area that addressed other themes in the literature, which are related to project and change management, there was also a similar match between the general orientation of the literature and the eHealth implementation at GJNH. Similarly, there were a number of eHealth specific constructs like the team organisation interacting and exchanging roles with the clinical community. Change management depended on clinicians in the process of determining the new features and pathways in the system, and in the ability of clinicians to convince others to use the system and train them when required. We

also saw that the approach and business plan of the eHealth implementation was based on the national eHealth strategy described earlier in the chapter.

In addition to testing existing theoretical frameworks around eHealth implementations, the case study resulted in new suggestions and themes related to eHealth initiatives. Such themes are around the role of champions and critical champions, the professional background of eHealth staff, the role of organisational strategy, and the effect of national policy on eHealth implementations. Some of the themes that emerged were typical project-related matters like project management and organisational structures around it. Others were more contemporary like suggestions for new training methods for clinical staff that improve adoption of the new implementation, and consequently the perceived success of the eHealth initiative.

The qualitative research not only identified the studied D&M model and other literature categories of themes, but also gave a certain level of depth around the constructs and characteristics of each theme. Accordingly, the original objective of testing the suitability of the D&M model in an eHealth implementation was served. Furthermore, providing eHealth specific definitions to those constructs enhanced their applicability to eHealth implementations. It also provided eHealth specific content to the themes identified elsewhere in the literature.

Interestingly, the case study highlighted a new set of themes that emerged as a by-product, which can be further explored and qualified to add to the knowledge and experience around eHealth implementations. Areas like the structure and level of clinical involvement, the national context and influence, the role of critical champions, the role of eHealth leadership, the relation between success and benefits, and effective training are all dimensions that are worth additional examination. Another level of exploration is needed to clarify those areas further and to confirm the validity of the eHealth specific constructs and sub-constructs across the whole organisation. The next chapter will describe and explain the quantitative research conducted through a survey to achieve those objectives.

CHAPTER 5. GOLDEN JUBILEE NATIONAL HOSPITAL EHEALTH SURVEY RESULTS

5.1 Introduction

As presented in Chapter 4, the case study was conducted through in-depth interviews with different users and stakeholders of the eHealth system, in addition to an investigation around the project background, and related documentations and reports. The content of the interview responses, and other related documents were analysed using the framework analysis method. The qualitative research analysis resulted in a number of findings. Some of those findings were in line with the predictions of the literature, whereas others were relatively new, or not as clearly described in the literature.

The requirement for a survey within GJNH in addition to the qualitative research emerged for two reasons. The first reason was to further test the general findings that were more or less in accordance with the findings of the literature review, and to attain this further support from a larger population sample. The other reason was to explore the new themes more broadly and to verify whether or not they were, in reality, new themes across the wider population of GJNH, or just personal input or preferences of the individuals interviewed.

5.2 Survey process

5.2.1 Questionnaire construct deduction

Fittingly, a survey was designed using the outcomes of the qualitative research. The extracted themes from the D&M model and literature were tackled with the qualitative GJNH case study. From its converging findings, influential implementation factors were extracted (detailed in Table 5.4, columns 1 to 3). These obtained success implementation factors were operationalised as survey questions (detailed in Table 5.1; Appendix C) along with people's general subjective evaluations of implementation success (detailed in Table 5.2). In other words, factors appearing to be important from the qualitative results and the literature were translated into short statements and answer-options based on established measurement principles (Bryman & Bell, 2007). This method allows the empirical accessibility, and hence quantitative assessment, of the perception of potentially important factors at a larger test-scale. Table 5.1 and Table 5.2 show exactly which previously extracted factor of importance was translated as a clear-cut, measurable aspect. The 'which'

hereby denotes a relevant implementation success characteristic and its translation into a survey statement; the ‘how’ defines the measurement scale applied. For the sake of robustness, the measurement of relevant implementation success factors formulated as statements was treated as being at the ordinal level of measurements with the response categories: 1 = “strongly disagree”, 2 = “disagree”, 3 = “neither disagree nor agree”, 4 = “agree”, 5 = “strongly agree. An “I don’t know” response option was included to avoid biased answers potentially occurring due to a forced-choice statement. Information of general interest was recorded by a meaningful answer format, outlined by the content of the question inquiring about the information itself. For example, asking people at GJNH how often they use the eHealth system suggests the use of a categorical frequency assessment (detailed in Table 5.3). Although initially planned, the general information could not be considered in the inferential analyses due to a small sample size, but is presented descriptively to briefly characterise the survey respondents. Finally, input from the team of GJNH served to refine the content of the survey questions in terms of clarity and suitability.

Table 5.1: Operationalisation of extracted influential implementation factors as survey questions

Previously extracted influential implementation factors (Chapter 4, section 4.3)	Operationalisation as survey question:
Involvement of clinicians	Q4: The involvement of the clinicians has been essential for the Implementation Success ¹
Organisation-wide effort	Q5: The implementation was not an eHealth department effort only, other departments were involved when needed, and it was an GJNH wide effort ¹
Clinical background of eHealth team	Q11: The clinical background of the eHealth team is essential ¹
Strong e-Health leadership style	Q10: eHealth team leadership is essential for eHealth implementation success ¹
Change champions’ importance	Q7: There were change champions during the implementation ¹ Q8: The role of change champions was essential ¹
Clinical strategy/organisational goal fulfilment: patient safety, patient-care, efficiency	Q9_PSE: In the implementation, the following organisational goals were targeted: -Patient safety ¹ Q9_PCS: In the implementation, the following organisational goals were targeted: -Patient-centred service ¹ Q9_Efficiency: In the implementation, the following organisational goals were targeted: -efficiency ¹
National health policy	Q12: Health policy in Scotland affected eHealth success at GJNH ¹
	¹ Answer options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree, I don’t know

Table 5.2: Operationalisation of people’s general subjective evaluations of implementation success

Overall evaluation	Operationalisation as survey question:
Judgments of overall implementation success	Q1: Overall, the eHealth implementation in GJNH has been successful ¹
Overall eHealth system satisfaction	Q2: I am satisfied with the eHealth systems overall ¹
Overall day-to-day benefit of eHealth system	Q3: Overall the eHealth systems are of NO benefit to me in doing my job day-to-day ¹
	¹ <i>Answer options:</i> strongly disagree, disagree, neither disagree nor agree, agree, strongly agree, I don’t know

Table 5.3: Operationalisation of general information of interest into survey questions

Information of interest:	Operationalisation as survey question:
Training method preference	Q6: The most suitable method for eHealth training for me is: <i>Answer options:</i> training through peers; online formal training; formal face to face training; training through social networks; training through peer groups; other, please specify below
Professional background and function at GJNH	Q13: My professional background and role at GJNH is: <i>Answer options:</i> Medical; Medical and management; nursing; nursing and management, allied health professional (AHP); AHP and management; administrative and clerical; IT; general management; finance; others
Employment duration at GJNH	Q14: I have been working at GJNH for: <i>Answer options:</i> Less than 1 year; 1-2 years; 3-5 years; 6-10years; more than 10 years
Age	Q15: My age is: <i>Answer options:</i> 25 years and under; 26-35 years; 36-45 years; 46-60 years; above 60 years
System usage frequency	Q16: I use the above systems: <i>Answer options:</i> More than once a day; once a day; three-times a week; once a week; once a month;

After establishing the questionnaire (Appendix C), the initial survey was pre-tested on a small sample of the GJNH population before being sent out to collect data of a larger sample at GJNH. The pre-test results (Appendix D, section 1, Table 1 to Table 8) served to establish confidence in the survey format and to ensure the survey would be well conceived when sent out to further GJNH employees. The pre-test solely served the purpose of an initial test and its data were not pooled with the main survey’s data. Prior to explicating the results of the main survey and the empirical validation of the hypotheses, these hypotheses to be tested are derived.

The hypotheses merge the themes and insights from the literature, the constructs that were emerging from the qualitative GJNH case study, as well as the extracted implementation success factors. As such, the hypotheses encapsulate large parts of the previously gained knowledge of this work and formulate them as testable statements. This results in four sets of hypotheses outlined by Column 4 of Table 5.4. The table presents the connections between the literature and the constructs from the qualitative case study that resulted in the extracted and operationalised success implementation factors and the conflation into corresponding hypotheses sets. Each hypotheses set will be examined and referred to separately in the following explications of the empirical survey results on a larger GJNH sample.

Table 5.4: Connection between the themes from the literature, the constructs from the qualitative GJNH case study, extracted implementation success factors and derived hypotheses sets

Themes from D&M Model and literature	Constructs emerging for the qualitative phase (Chapter 4, section 4.3)	Extraction of influential implementation factors	Derived hypotheses (sets)
System quality	<p>System is built by a responsive eHealth team.</p> <p>System is built through the feedback of Doctors, Nurses, Pharmacists, administrators, eHealth and IT members.</p> <p>System that support patient care:</p> <ul style="list-style-type: none"> • Makes clinicians effective and more productive. • Help clinicians in their day-to-day job by providing information. • Delivers on the clinical strategy. <p>(6-2) The quality of the eHealth department: “A lot of the success of the that strategy is predicated on the eHealth department, and them having not only a very good IT resources, but also them having a very captive clinicians orientated culture.</p> <p>The system is user friendly as clinicians were involved in its delivery.</p>	Clinical background of eHealth people; involvement of clinicians; clinical strategy/goal fulfilment; efficiency benefits; strong eHealth leadership	<p>Hypotheses set 1: Overall perceived implementation success of eHealth (Q1) is multi-faceted and related to:</p> <p><i>H1.1:</i> the degree of perceived clinician’s involvement (Q4)</p> <p><i>H1.2:</i> the extent of a perceived organisation-wide effort (Q5)</p> <p><i>H1.3:</i> the clinical background of the eHealth team (Q11)</p> <p><i>H1.4:</i> the perceived leadership efforts (Q10)</p> <p><i>H1.5:</i> the perceived essential role of change champions (Q8)</p> <p><i>H1.6:</i> the perceived influence of the Scottish health policy (Q12)</p>
eHealth vision and business plan	<p>The vision of the project is the National eHealth vision.</p> <p>There needs to be a strategy that people work towards.</p> <p>Local business plan approved by the board and aligns with the national strategy.</p>	National health policy, clinical strategy/goal fulfilment	<p>Hypotheses set 2: The identified influential implementation factors should differ in their perceived degree to which they were essential to eHealth success:</p> <p><i>H2.1:</i> The leadership team (Q10) should be seen more essential for implementation success compared to the role of change champions (Q8).</p> <p><i>H2.2:</i> The perceived leadership effort (Q10) as well as the clinical background of the eHealth (Q11) team both should be perceived equally essential for success.</p> <p><i>H2.3:</i> The involvement of the clinicians (Q4) should be equally perceived to be essential for implementation success as the organisations- wide effort (Q5) was essential.</p>
Information quality	<p>Involvement of clinicians improves information quality.</p> <p>Provides clinical information, and management information.</p> <p>Clinical outputs includes <i>Operations Notes, Discharge Summaries, clinical pathways...</i></p> <p>It also produces information for external monitoring.</p> <p>Clinical information, more can be done around:</p> <p>Clinical outcomes.</p> <p>Mortality and morbidity.</p> <p>“Up to the board level, where we can look from a high level at that data, but also incorporate to see if there are complaints, issues with patients, and then we get even to a higher level to the government to give assurance that national target, the performance targets, are meeting the financial targets; they give us and the safety of patients.”</p>	Clinician’s involvement, clinical strategy/goal fulfilment	
Service quality	<p>Clinicians are involved.</p> <p>There is an open dialogue between departments, and discussions around issues and problems.</p>	Clinicians’ involvement; organisation-wide effort	

Enterprise communication	<p>Engaging various groups.</p> <p>eHealth team to attend regular meetings of other groups to promote usage, in addition to direct visits to users.</p> <p>Each project has a clinical representative who communicates with his/her group.</p> <p>Every team had a qualified clinician who communicated to the rest of the clinicians' community.</p>	Clinicians' involvement; organisation-wide effort	
Change management	<p>Direct engagement with users and potential users.</p> <p>Everyone is briefed on the risk and issues and proposed changes.</p> <p>It is within the governance of project boards and groups.</p> <p>When resistance occurs, the head of eHealth works with involved clinicians on solving the issues.</p> <p>Involvement is essential for success.</p> <p>It is based on Champions.</p>	Clinicians' involvement; Change champions' importance;	
Project management	<p>Involved users.</p> <p>Project management style was not enforcing, but one of involvement, listening, and engaging.</p> <p>Clinicians involved in project boards and project groups.</p>	eHealth leadership style	
Implementation team structure	<p>The implementation team is made from: project team leads, project workers, IT department members, infrastructure team, and clinicians.</p> <p>Clinical involvement is essential to project success for any system in a hospital setting.</p> <p>Champions of change are important in eHealth implementation, especially Critical Champions, who are critical about everything and think it's not good enough, yet they're very driven, motivated, and good communicators.</p> <p>(8-1) eHealth involves clinicians and other staff.</p> <p>Early engagement of the clinical team is important to allow them to determine what is needed and communicate that to the eHealth team.</p> <p>Teams are built according to:</p> <ul style="list-style-type: none"> The type of system implemented. The department the system serves. <p>The chair of the project team is selected based on specialty and experience, and she/he picks their team.</p> <p>Clinical involvement starts from idea generation all the way to closing of the project, and includes all specialties.</p>	eHealth leadership style; organisation-wide effort; change-champions importance; clinical background of eHealth team	
The quality of system selection	<p>It was a result of clinicians' feedback and interacting with the vendor to get the actual requirements from the system.</p>	Clinicians' involvement	

and implementation			
System use	90% of medical staff are using the system. Satisfaction is low (4 out of 10). The system is being used, especially to access patients' information. Old clinicians represent the main challenge to system use.	System use ¹ despite relatively low system satisfaction	<i>Hypotheses set 3:</i> Overall eHealth judgments regarding implementation success perception (Q1) , system satisfaction (Q2) , and system benefits (Q3) evaluation may diverge. <i>H3.1:</i> eHealth system satisfaction (Q2) and judgments of perceived system benefits (Q3) are independent. This means that someone sees the system as beneficial does not allow conclusions in how far someone is satisfied with the system. <i>H3.2:</i> Overall perceived implementation success (Q1) is associated with the degree of perceived benefit of the system (Q3) <i>H3.3:</i> Overall perceived implementation success (Q1) is not related to the satisfaction with the system (Q2) .
Net benefits	Improves accuracy and patient safety. Improves patient care. Increases efficiency. Systems are about fulfilling strategic outcomes like: Minimising waste. Making people more efficient. Supporting clinical decision-making. Many performance benefits that can be measured. Patient safety benefits.	Net benefits: patient safety, patient-care, efficiency	
Overall project success	Projects delivered their targets. It is not about delivering a system and meeting deadlines, but it is about delivering results.	Clinical strategy/ organisational goal fulfilment	<i>Hypotheses set 4:</i> Judgments of perceived system benefits (Q3) is related to targeted organisational goals of patient-safety, patient-centeredness, efficiency (Q9_PSE, Q9_PCE, Q9_EFF) ; both should be related to the perception eHealth implementation as successful (Q1) <i>H4.1:</i> Perceived benefits are associated with the perceived degree of organisational goal fulfilment (Q9_PSE, Q9_PCE, Q9_EFF) <i>H4.2:</i> organisational goal fulfilment (Q9_PSE, Q9_PCE, Q9_EFF) itself is related to overall perceived success (Q1) <i>(cf. H3.2):</i> Perceived system benefits (Q3) are associated with perceived implementation success (Q1)

¹ Since the distribution of the answers to Q16, most people used the system multiple times daily, lacked sufficient variance; Q16 was disregarded from further inferential considerations.

Having previously presented the theoretical and practical framework of the main survey, the actual conduct of the larger-scale survey at GJNH is explained. This starts with a brief outline of the survey and its sample; that is, characteristics of the respondents of the larger-scale GJNH survey. Thereafter, follows the descriptive evaluation of eHealth implementation success and the perceived significance of various implementation success factors identified in the previous chapters of this study (Figure 5.1 to Figure 5.8; Appendix D, Section 2.1, Figure 1 to Figure 4). The descriptive analyses are complemented, later on, by the inferential analyses testing the previously stated hypotheses sets (Table 5.6 and Table 5.7). After presenting the deductive results, Table 5.9 and 5.10 depict a summary of the inductive findings. The chapter ends with a brief concluding summary.

5.3 GJNH-wide survey introduction

The survey aimed at scrutinising findings from the preceding qualitative interviews, and thereby potentially extending the previously drawn conclusion. The survey was distributed through emails addressed from the Manchester Business School (MBS) doctoral program to the users of the eHealth systems at GJNH with a link to a web page that contained the survey. The data was then collected through a centralised server provided by MBS, and analysed using SPSS 22 and Excel software. The content and format of the survey remained the same as in the pre-test version.

58 individuals responded to the survey out of an estimated total number of 250 users. This makes the response rate about 23%, which can be considered an average response rate according to similar surveys.

5.3.1 Descriptive results—Characterising the GJNH sample:

Of the total number of respondents, 80% were frequent Clinical Portal users (more than once a day or once a day portal usage; see Appendix D, Figure 1). Most respondents were eHealth-system end-users and their professional background was largely clinical (69%), of which most were nursing staff (36%) and clinicians (19%). The bar graph below (Figure 5.1) shows the respondents' professional background.

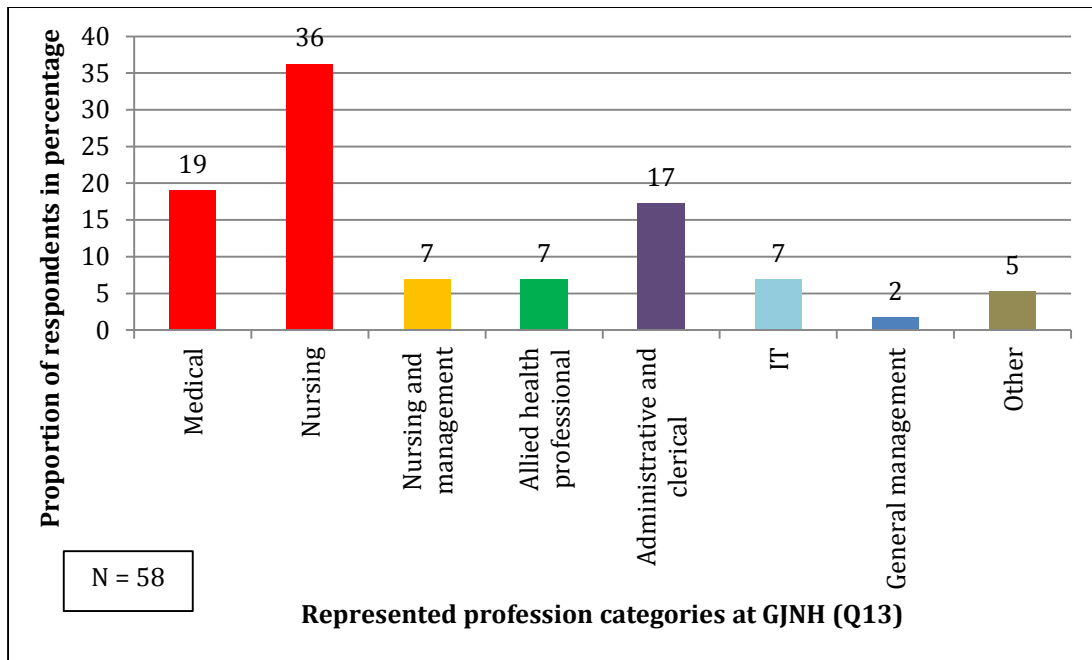


Figure 5.1: Professional background and role of respondents at GJNH

Furthermore, most respondents have long-term employee relationships with GJNH and have been working for 6-10 years (53%) at the organisation. Relatively few people have worked at GJNH for less than two years (16%).

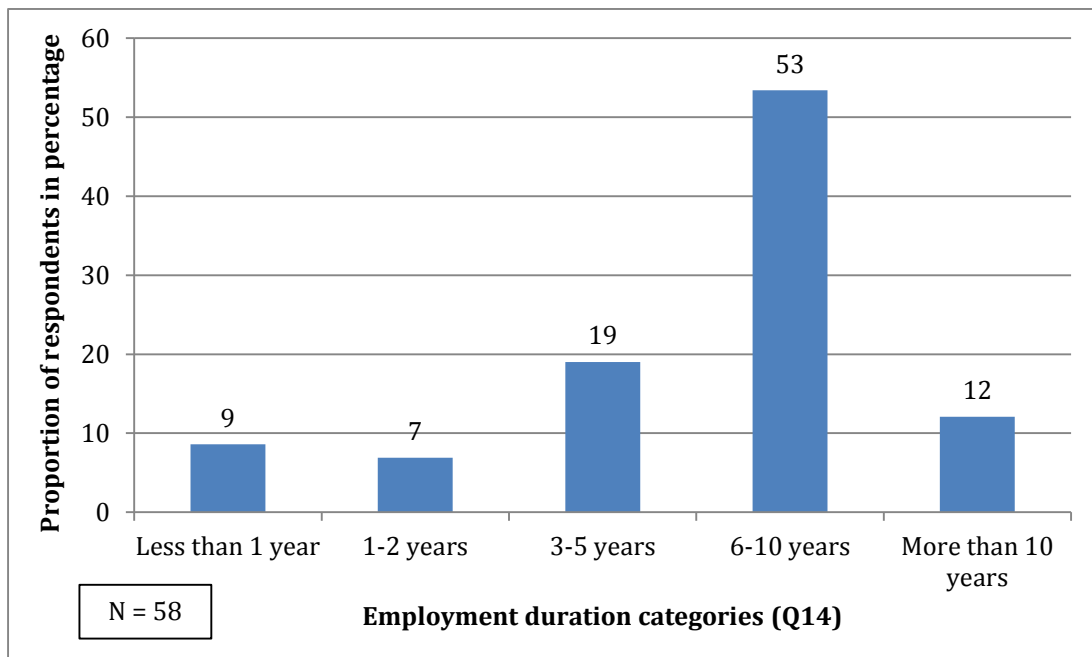


Figure 5.2: Employment duration at GJNH

In terms of the respondents' ages, the majority of people were middle-aged and between 45 and 60 years old (Figure 5.3). When it comes to eHealth training methods (Figure 5.4), 40% of users preferred formal face-to-face training. Training through peers or formal online training is less popular. Despite the peer-training popularity, training by peer-groups rather than just individual peers is not favoured.

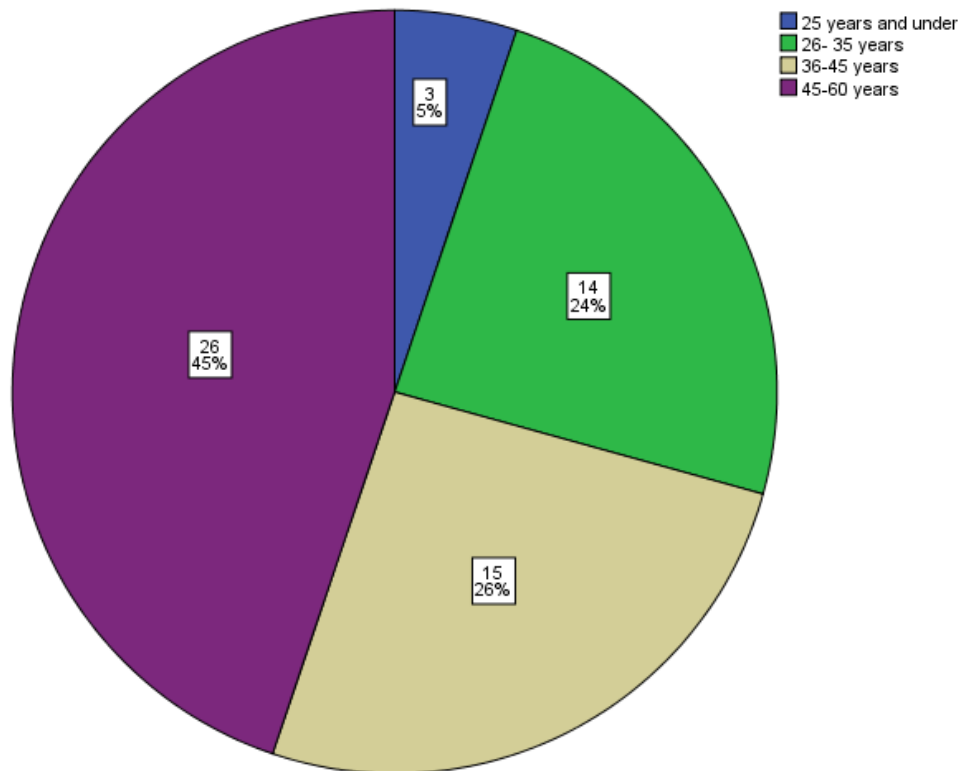


Figure 5.3: Respondents' age distribution in frequencies and percentages (Q15)

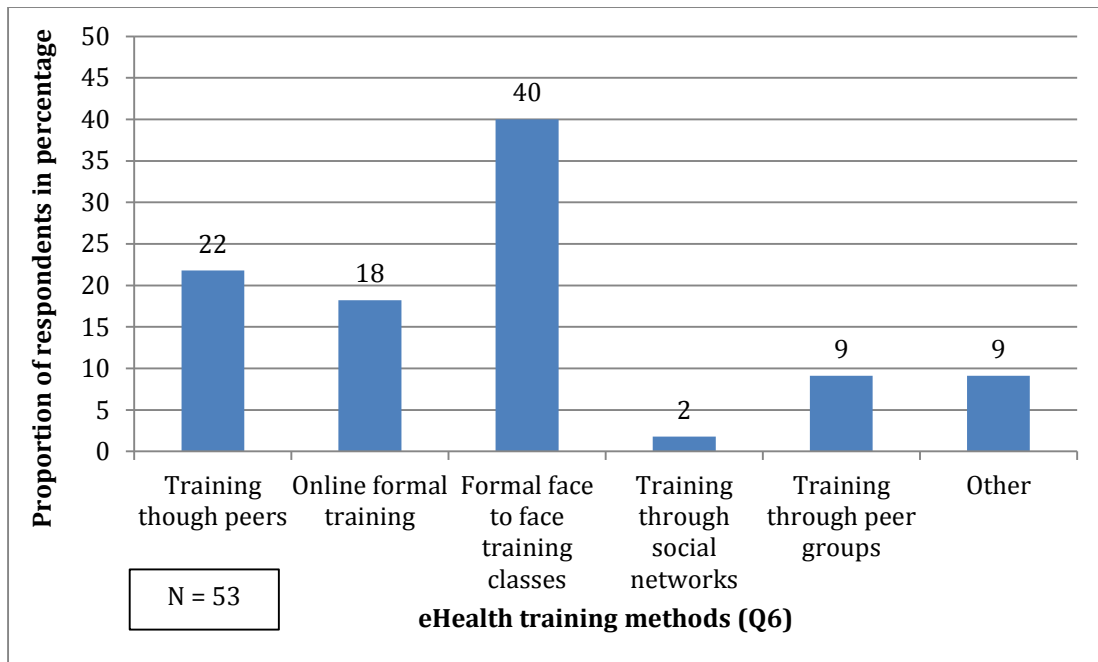
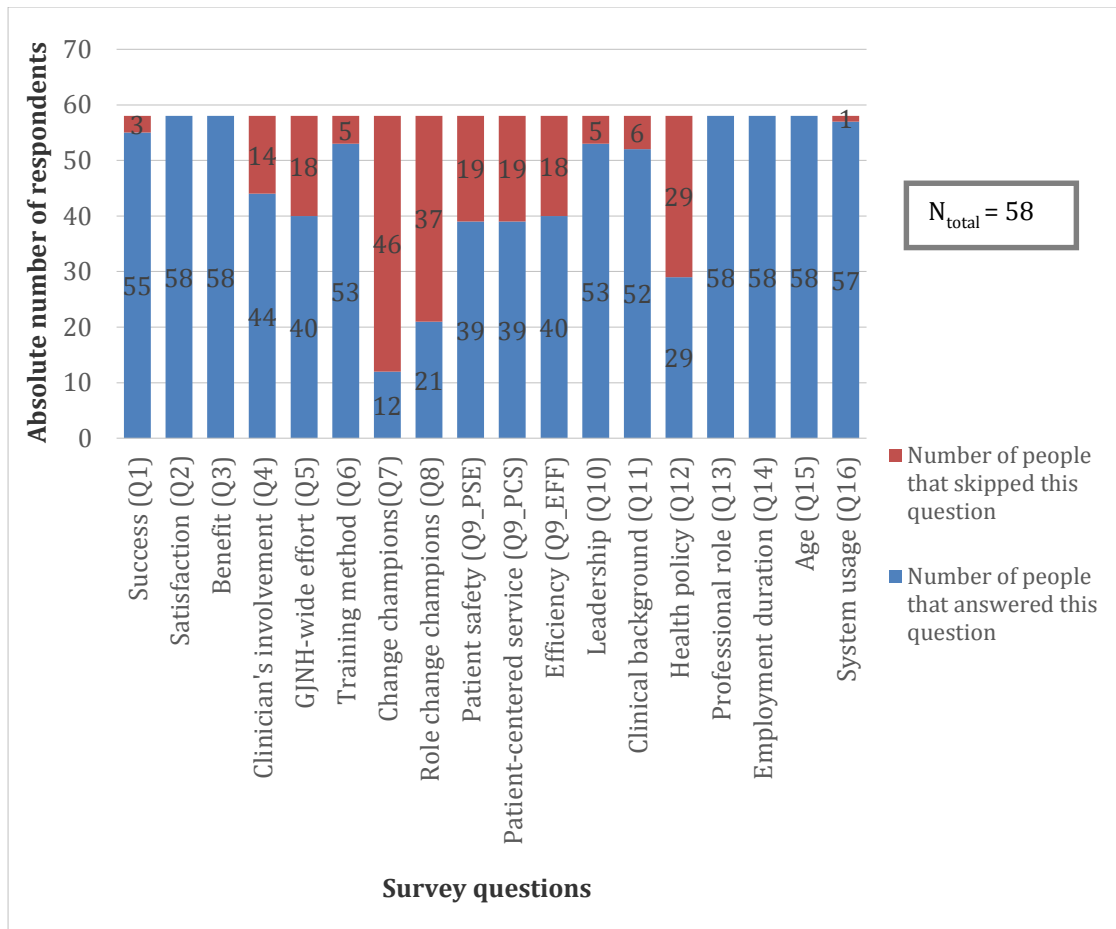


Figure 5.4: Respondents' evaluation of the favourability of various eHealth training methods

The majority of all survey respondents answered almost all questions (Figure 5.5). Yet, three questions seemed to be difficult for GJNH employees: 29 persons did not know if the "Health policy in Scotland affected the eHealth success at GJNH". Even more unclear for 46 respondents was whether or not there were change champions during the implementation, and correspondingly for 37 persons, if "the role of the change champions was essential".



Note: The Y-axis represents the frequency of respondents who participated in the survey, and how many of them responded to a certain question is represented at the X-axis.

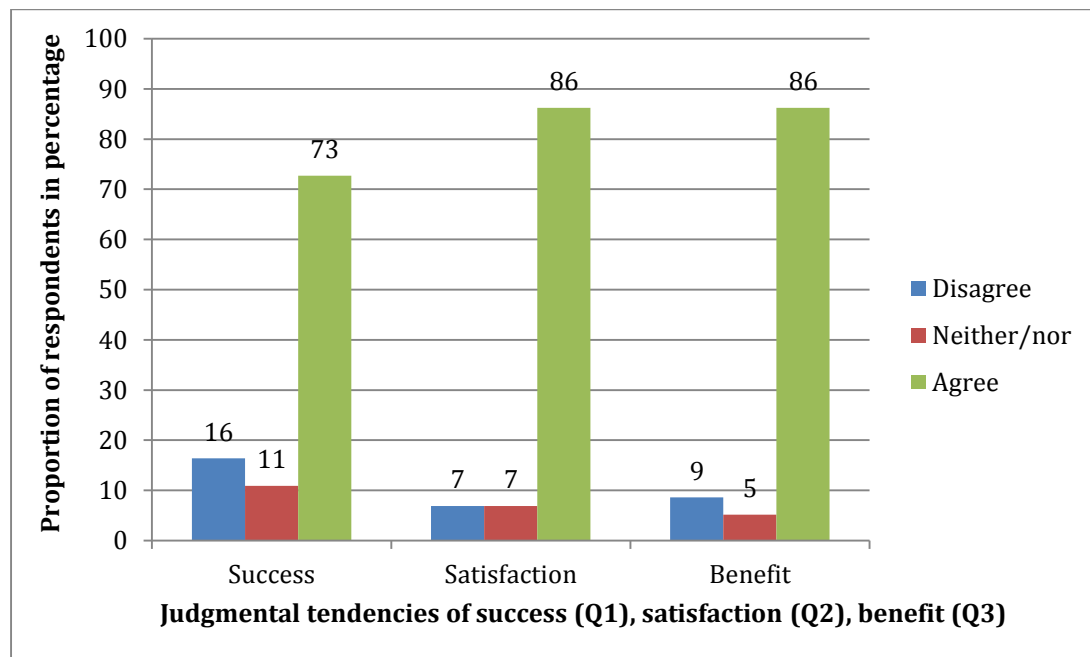
Figure 5.5: Non-responses across all respondents and survey questions in absolute numbers

After having examined the survey respondents’ characteristics and their response rates related to the various survey questions, the following descriptive focus turns to respondents’ subjective evaluations of the eHealth implementation at GJNH.

To allow a concise presentation of the results without changing meaning, respondents’ answer tendencies to agree or disagree with the survey’s statements were collapsed and expressed in percentages. To get to those percentages displayed in the subsequent figures, the percentages of those who answered, “strongly agree”, and of those who responded with, “agree”, were added to comprise the percentages

of respondents with a similar opinion. Equivalently, respondents' answers to "strongly disagree" or "disagree" were subsumed under the label "disagree" (see Appendix D, section 2.1, Figure 2 to 4 for non-collapsed displays of the subsequent figures).

Considering peoples' general evaluations of the eHealth system, their satisfaction with the system, and their opinion about daily benefits of the system (Variables Q1 to Q3), an overall positive evaluation can be noted (Figure 5.6). Most surveyed GJNH employees perceive the implemented eHealth system, overall, as successful (72%) and beneficial (86%) to their day-to-day job practice, as they are satisfied with the eHealth system on the whole.

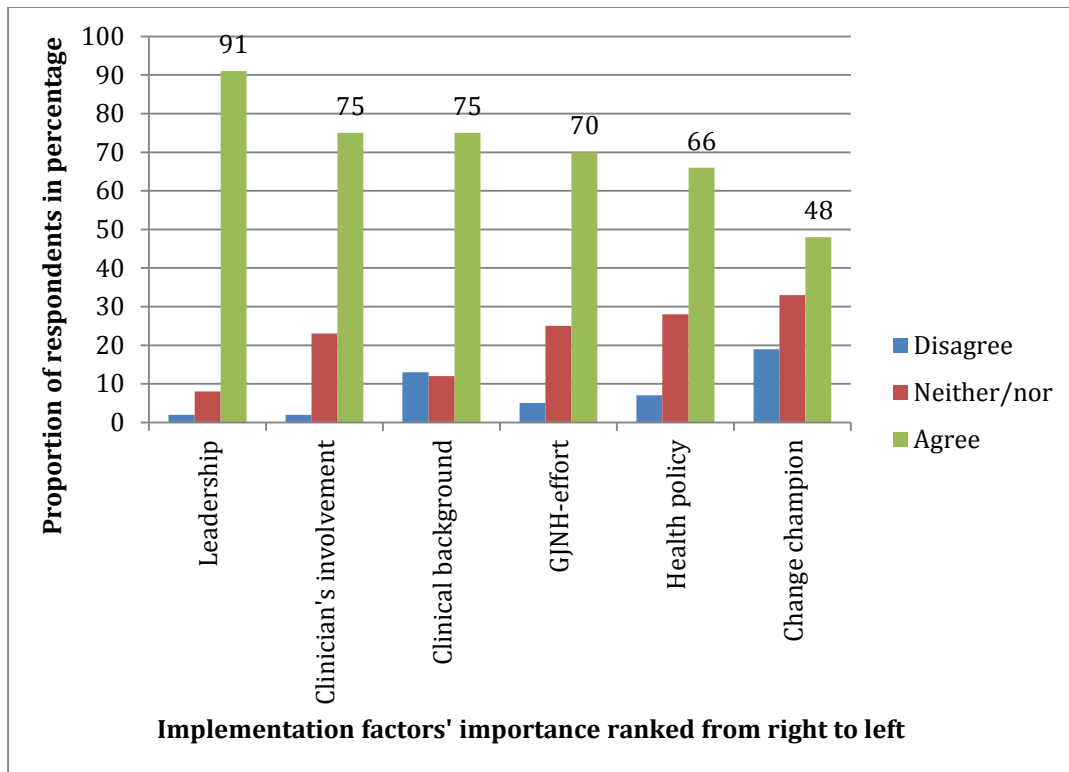


Note: $N_{\text{success}} = 55$, $N_{\text{satisfaction}} = 58$, $N_{\text{benefit}} = 58$; the original variable Q3 "no-benefit" was reversed to represent a variable capturing the "benefit" of the system for the sake of interpretation.

Figure 5.6: Evaluation of eHealth implementation success, system satisfaction, and daily system benefits

The subjective evaluations of various factors to be influential to eHealth implementation success are displayed in Figure 5.7. A comparison of the frequency of response tendencies to agree or disagree regarding different implementation factors' essentiality for implementation success resulted in a simple order of factors to be perceived as substantial. This comparison is rooted in the exact wording of questions Q4, Q5, Q10, Q11, and Q12 asking how much a person agrees or disagrees with "how essential" a particular factor for implementation success is. The framing of the questions entails, explicitly, an importance judgment. Implicitly, it allows a comparison of how important the factors are perceived relative to each other. This notion entails potential overlap in importance perception, but still allows a comparison of how many people rate a factor to be essentially important, despite not being originally designed for this purpose.

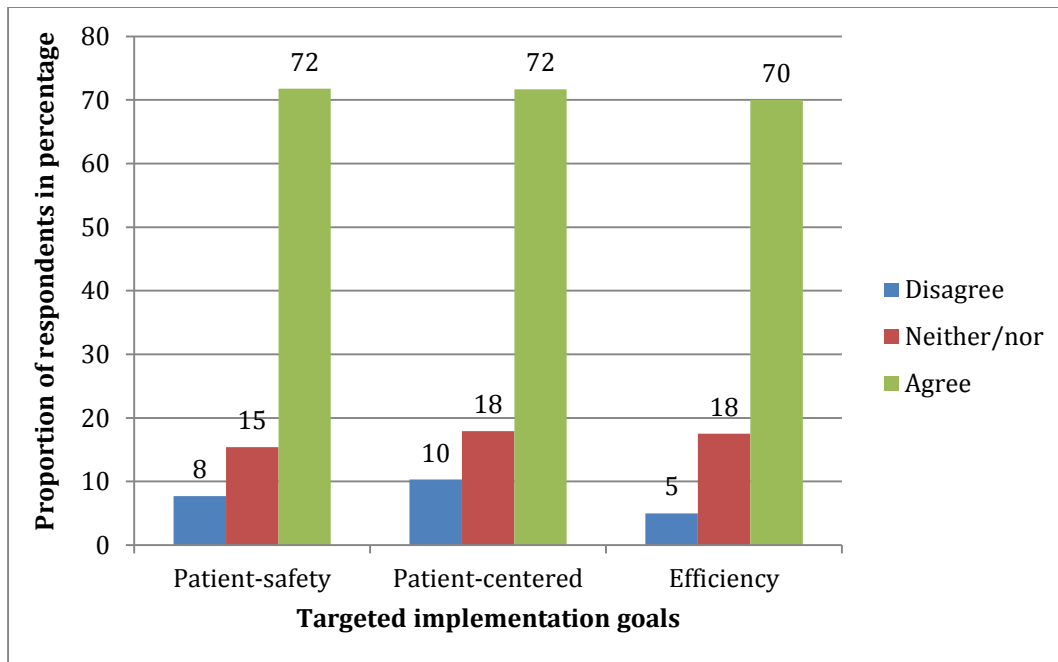
Accordingly, 91% of respondents viewed eHealth leadership as the most important success factor. The least significant factor seems to be the role of the change champions. Only 48% of those who did not skip the questions about how essential change champions were for success, agreed to its importance. In second place, 75% of respondents viewed the involvement of clinicians during the implementation as important. As well, 75% agreed on the importance of the clinical background of the eHealth team as a success factor. With just 5% less at 70%, respondents viewed that the implementation success was not an eHealth department effort only; other departments were involved when needed, and it was a GJNH-wide effort. Comparatively, 65.5% believed that the health policy of Scotland played an important role in the success of the implementation.



Note: $N_{leadership} = 53$, $N_{involvement} = 44$, $N_{background} = 52$, $N_{wide-effort} = 40$, $N_{health\ policy} = 29$, $N_{champions} = 21$

Figure 5.7: Evaluation and ranking of respondents' perceived essentiality of multiple implementation factors for eHealth success

When evaluating large-scale implementation projects, another aspect of interest is the degree to which people think the implementation goals were met. Related to eHealth implementation success, almost 2/3 of respondents who could answer the question about the degree of fulfilling targeted implementation goals, viewed the goals to be successfully tackled (Figure 5.8). Noteworthy, is the similar agreement related to the degree to which the organisational goals were fulfilled, ranging from 70% to 72%.



Note: $N_{\text{patient-safety}} = 39$, $N_{\text{patient-centeredness}} = 39$, $N_{\text{efficiency}} = 40$

Figure 5.8: Judgmental tendencies to perceive organisational goals to be targeted during the implementation

5.3.2 Inferential analyses—testing the hypotheses sets

After presenting the descriptive survey findings, inferential analyses move beyond a descriptive level, augmenting the knowledge to be gained from the survey data. The following correlation analyses aim at unravelling the association between the assessed concepts and to test the previously stated hypotheses (Table 5.4). To recap, the hypotheses sets are testable statements clustered around themes comprising different aspects of implementation success factors that were derived from the literature (D&M Model and other theoretical frameworks); and elements based on the qualitative interviews. As such, the following section examines the proposed relationships of each hypothesis set on a larger sample to elucidate perceived eHealth implementation success. To serve this purpose, each set of hypotheses is listed again. Then, the applied statistical test of the hypotheses and related findings follow succinctly, finishing off with a short summary of the hypotheses' support or refutation.

Given the ordinal nature of the measured concepts, non-parametric analyses

were carried out. As the metric of correlation between these variables, Kendall's tau has been preferred since there are many tied ranks and Kendall's is superior to Spearman's for generalising from samples to populations (Field, 2013). The reported bivariate correlation coefficients are based, consequentially, on parameter estimated from Kendall's tau. Since the use of one-tailed tests is subject to a debate (summarised by the arguments of Lombardi and Hurlbert (2009), and Siegel (1956)) and a conservative data analyses approach is taken, all significance tests carried out are two-tailed. An overview of the relationships between variables in the survey, directly related to the hypotheses tests, are presented in Table 5.6, whereas Table 5.7 shows an overview of the tested hypotheses and their deductive results. Figure 5.9 and 5.10 is a visualisation of significant correlations displayed in Table 5.6, sparing any non-significant correlations and the correlations of Question 7 due to a very low number of respondents. As such, Figure 5.9 and 5.10 both represent an overview that summarises all the correlation results among the questionnaire variables Q1 to Q12, graphically. These figures will be briefly discussed in section 5.4, the concluding section of the chapter, because their information does not represent the central deductive focus of this chapter. It is noteworthy here, that the reported correlations are bi-directional and do not disentangle between cause and effect, but merely depict an association.

For the following analyses, the three aspects (patient-safety, patient-centeredness, and efficiency) were combined into one variable "goal fulfilment". They are a measure of the same concept "organisational goal fulfilment" and are numerically similar. Accordingly, checking the internal consistency of this combined scale reveals its reliability: Cronbach's Alpha of .93. As such, for the following inferential analyses, these three sub-aspects are condensed into one variable goal fulfilment, labelled "Scale".

Table 5.5: Bivariate correlations between respondents' evaluations of the survey statements (Q1 to Q5; Q7 to Q12)

	Mean	SD	Q1	Q2	Q3	Q4	Q5	Q7	Q8	Q9	Q9	Q9	Scale	Q10	Q11	Q12
Q1: Overall success	3.78	1.31	--													
Q2: Overall satisfaction	3.98	.81	.41**	--												
Q3: Overall benefit	4.33	1.03	.11	.36**	--											
Q4: Clinicians involvement	4.11	.84	.15	.11	-.02	--										
Q5: GJNH-wide effort	3.8	.85	.12	.38**	.15	.58**	--									
Q7: Change champions	2.63	.75	.24	-.34	-.57	-.30	-.64*	--								
Q8: Essentiality of champions	3.38	1.07	-.11	.46*	.43*	.14	.39	-.76**	--							
Q9: Patient-safety	3.82	1.02	.24	.47**	.29*	.33*	.50**	-.35	.40*	--						
Q9: Patient-centred service	3.72	1.05	.25	.38**	.26	.29	.51**	-.32	.26	.78**	--					
Q9: Efficiency	3.93	.94	.27	.42**	.39**	.35*	.50**	-.53	.47*	.66**	.66**	--				
Scale: Goal fulfilment			.29*	.47**	.33*	.33*	.47**	-.37	.39*	.89**	.75**	.84**	--			
Q10: Leadership effort	4.21	.66	.01	.22	.27*	.24	.46**	-.56	.43*	.23	.27	.31*	-.25	--		
Q11: Clinical background	3.73	.91	.11	.09	.01	.30*	.40**	-.44	.46*	.33*	.45**	.27	.31*	.09	--	
Q12: Scotland's health policy	3.69	.89	-.22	.28	.36*	.07	.40*	-.18	.32	.50**	.37*	.44*	.45**	.32	.21	--

Color legend

- Results relevant to Hypotheses set 1
- Results relevant for Hypotheses set 3
- Results relevant for Hypotheses set 4
- Caution: Values based on low N = 10 to 12

Note: Bivariate correlation coefficients (Kendal's Tau) of the variables Q1 to Q12 represent the association of the survey respondent's extent to agree or disagree with the survey question statements; significant values are marked by ** $p < .01$, * $p < .05$; all correlations based on two-tailed testing. **Q3** is reversed to represent benefits rather than no-benefits. Grey marked coefficients should be treated with caution since the values are based on a very low number of respondents, varying from N = 10 to N = 12).

Table 5.6: Overview of the tested hypotheses, analyses performed, and their results

Hypotheses list	Variables involved	Two-tailed tests with p- value of .05	Hypotheses rejected or retained	Comments
H1.1	Q1 and Q4	Non-parametric bivariate correlations; Kendall's Tau significant at $p < .055$ for Q1 with Q4, Q5, Q11, Q10, Q8, Q12	Rejected, no empirical support	Result unexpected, not even significant at $p < .10$
H1.2	Q1 and Q5		Rejected, no empirical support	Result unexpected, not even significant at $p < .10$
H1.3	Q1 and Q11		Rejected, no empirical support	Result unexpected, not even significant at $p < .10$
H.1.4	Q1 and Q10		Rejected, no empirical support	Result unexpected, not even significant at $p < .10$
H.1.5	Q1 and Q8		Rejected, no empirical support	Result unexpected, not even significant at $p < .10$
H1.6	Q1 and Q12		Rejected, no empirical support	Result unexpected, not even significant at $p < .10$
H2.1	Q10 and Q8	Non-parametric paired difference test of mean ranks; significant Wilcoxon signed-rank tests at $p < .05$ of the variable pair Q10 > Q8; non-significant for pairings Q10 and Q11, as well as Q4 and Q5	Retained, empirical support	Result as expected
H2.2	Q10 and Q11		Rejected, no empirical support	Result unexpected
H2.3	Q4 and Q5		Retained, empirical support	Result as expected
H3.1	Q2 and Q3r	Non-parametric bivariate correlations; Kendall's Tau non-significant at $p < .05$ for Q2 with Q3r, Q1 and Q2; significant for Q1 and Q3r	Rejected, no empirical support	Result opposite to expectation
H3.2 (c.f. H.4.3)	Q1 and Q3r		Rejected, no empirical support	Result opposite to expectation
H3.3	Q1 and Q2		Rejected, no empirical support	Result opposite to expectation
H4.1	Q3r and combined scale of Q9_PSE, Q9_PCE, Q9_EFF	Non-parametric bivariate correlations; Kendall's Tau significant at $p < .05$ for Q3r with combined scale Q9_PSE, Q9_PCE, Q9_EFF; and for Q1 with combined scale Q9_PSE, Q9_PCE, Q9_EFF	Retained, partial empirical support	Retained when organisational goals (Q9_PSE, Q9_PCE, Q9_EFF) are combined into one scale "goals" (Cronbach's Alpha = .93), otherwise Q9_PSE, Q9_PCE, Q9_EFF on their own not significant at $p < .05$, two-tailed, but at $p < .05$, one-tailed
H4.2	Q1 and combined scale of Q9_PSE, Q9_PCE, Q9_EFF		Retained, partial empirical support	Retained when organisational goals (Q9_PSE, Q9_PCE, Q9_EFF) are combined into one scale "goals"), otherwise Q9_PSE, Q9_PCE, Q9_EFF on their own not significant at $p < .05$, two-tailed, but at $p < .05$, one-tailed.

Examination of the Hypotheses Set 1

As made apparent from the identified success factors in the literature and the qualitative analyses, Hypotheses Set 1 proposes that, overall, the perceived success of eHealth implementation is multi-faceted and associated with (Figure 5.11):

H1.1: the degree of perceived clinician's involvement

H1.2: the extent of a perceived organisation-wide effort

H1.3: the clinical background of the eHealth people

H1.4: the perceived leadership efforts

H1.5: the perceived essential role of change champions

H1.6: the perceived facilitative framework of the Scottish health policy

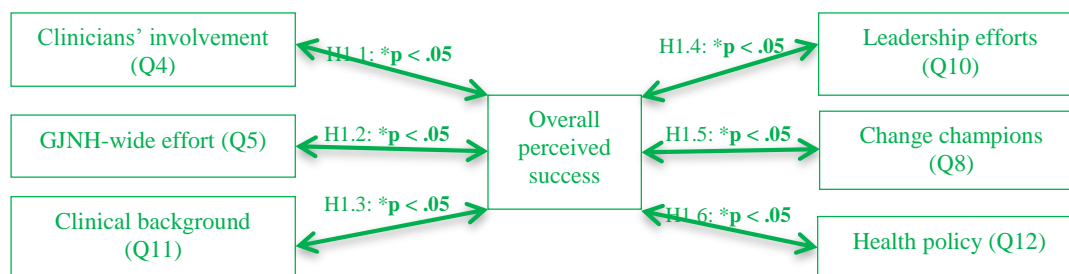


Figure 5.9: Expected associations of Hypotheses Set 1

Surprisingly, the expected statistical association of overall success (Q1) and various implementation factors (Q4, Q5, Q8, Q10, Q11, Q12; see Appendix C) is not obtained, all p s > .10. This unexpected lack of supportive findings is also replicated by a multivariate linear regression approach (see Appendix D, section 2.3.1). Despite the lack of correlation, coefficients point in the expected direction, and as such, the evidence is insufficient. Thus, Hypotheses Set 1 cannot be supported and is rejected.

Examination of the Hypotheses Set 2

As the interviews pointed towards differences in the importance of some implementation factors over others, Hypotheses Set 2 states that the multiple factors assumed to be perceived to be related to eHealth implementation success should differ in their apparent degree to which they are judged to be significant contributors to its success. According to the input from the qualitative interviews,

the factors include:

H2.1: The efforts of the leadership team should be perceived to be a more important factor of implementation success compared to the role of change champion's contribution to success.

H2.2: The perceived leadership quality as well as the clinical background of the eHealth team is both perceived equally important for success.

H2.3: The involvement of the clinicians is equally perceived to be important for implementation success as the organisation-wide effort is essential.

The framing of the questions about the clinical background of the eHealth team, the leadership effort of the eHealth team, the role of the change champions, and the involvement of the clinicians as a statement to agree or disagree related to how "essential" these factors are perceived for eHealth implementation success is similar. This match permits non-parametric comparisons of their mean ranks, according to Wilcoxon, signed-rank to investigate their potentially diverging perceived importance (Corder & Foreman, 2009). The idea being, the central tendencies of the variables (median) should significantly differ in their size according to the direction formulated in the hypotheses. The median comparison in H2.1 assumes a higher median of survey respondents' answers to the importance of leadership effort compared to the median tackling the role of the change champions. Supporting H2.1, respondents perceived the eHealth leadership efforts as more essential for implementation success than the role of the change champions, Wilcoxon signed-rank test, $Z = -2.8, p < .01$.

In the testing of both, the eHealth team leadership effort and their clinical background was perceived of equal importance and shows a greater attribution of leadership efforts as essential for implementation success, Wilcoxon signed-rank test, $Z = -2.86, p < .01$. Thus, H2.2 is refuted.

Testing H2.3, of both factors for success, an organisation-wide effort and the involvement of the clinicians in implementing eHealth, were conceived to be equally important, and found support for this notion. No differences in the central tendency

of both variables were found, Wilcoxon signed-rank test, $Z = -1.03$, $p = .31$.

Despite the lack of correlation of these factors with overall success, the framing of the statements asking respondents to evaluate multiple implementation factors how essential they were for success, entails the notion of success and hence permits these conclusions: the empirical evidence supports H2.1 and H2.3.

Examination of the Hypotheses Set 3

From the previous qualitative results, a link emerged between employees' day-to-day work benefit and how successful they evaluate the eHealth implementation as well as to what extent they are satisfied with the eHealth system. The interviewees' comments suggest that how satisfied a person is with the system is not necessarily related to that person's reported evaluation of its daily benefit. Opinions about both may diverge. Yet, how much daily benefit is attributed to the eHealth system has been repeatedly mentioned in respect to implementation success. Hence, the dissociation hypothesis set proposes (Figure 5.12):

H3.1: eHealth system satisfaction and perceived benefits are independent.

This means that someone who sees the system as beneficial does not relate to satisfaction with the system.

H3.2: Overall perceived implementation success is associated with the degree of perceived benefit of the system.

H3.3: Overall perceived implementation success is not related to the satisfaction with the system.

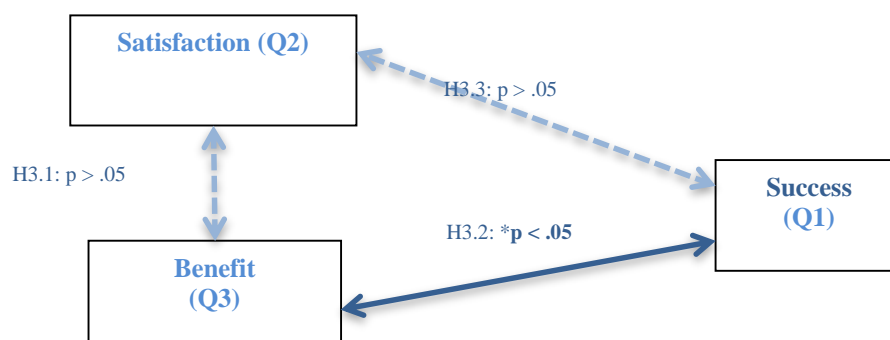


Figure 5.10: Expected associations of Hypotheses set 3

Unlike what was proposed in H3.1, a medium-sized positive correlation

between system benefit and system satisfaction was found here. Respondents' opinions about daily system benefits were indeed related to their overall system satisfaction ($r_{\tau} = .36, p < .01$; accounting for 13% of the relationship's variance): the more benefit employees gained from the system, the more satisfied they reported to be. This finding opposes H3.1, and predicted a non-significant correlation.

Contrary to H3.2, the expected statistical relationship between system benefits and success evaluation was not obtained. ($r_{\tau} = .11, p = .37$). This result was surprising and discrepant from the qualitative findings. By means of a jittered scatterplot (Appendix D, section 2.2, Figure 5, graph 2), a group of respondents with deviating response patterns from the noted main trend was identified. These employees rated the system to be beneficial to their daily work, but the implementation not to be successful overall. Inspection of their background showed no clear-cut single obvious commonality, but they seem to share a couple of similarities. Half of these persons had a nursing background, were in the age category of 26-35 years, but employed at GJNH for 3-10 years; and half of them did not know if the targeted organisational goals were focused on during the implementation. Finally, opposed to H3.3, the mere degree of how satisfied someone is with the system is actually linked to the overall implementation success by a medium-sized positive correlation ($r_{\tau} = .41, p < .01$; accounting for 20% of the relationship's variance; Table 5.6). In other words, the more people reported to be satisfied with the system, the higher were the indicated judgmental tendencies to agree that eHealth implementation was successful. In summary, H3.1 to H3.3 are rejected.

Examination of the Hypotheses Set 4

Since the eHealth implementation aims at supporting a better health service and improved security for patients, while being time-saving and efficiency-enhancing for the GJNH employees, perceived day-to-day benefits and strategic goal fulfilment should go hand in hand. Thus, they are likely to be related and have overlapping links to overall implementation success judgments, but since successfully targeted organisational goals as patient safety, patient-centeredness, and efficiency are not

directly observable for employees, they may rely on their experienced daily system benefit to assess organisational goal fulfilment and overall system implementation success (Figure 5.13).

This relationship is captured in Hypotheses Set 4. Judgments of perceived day-to-day system benefits and successfully targeted organisational goals are linked and both related to the perception of implementation success:

H4.1: Perceived benefits are associated with the perceived degree of strategic goal fulfilment (efficiency, safety, patient-focused).

H4.2: Strategic goal fulfilment itself is related to overall perceived success.

(H4.3/cf. H3.2): Perceived system benefits are associated with perceived implementation success.

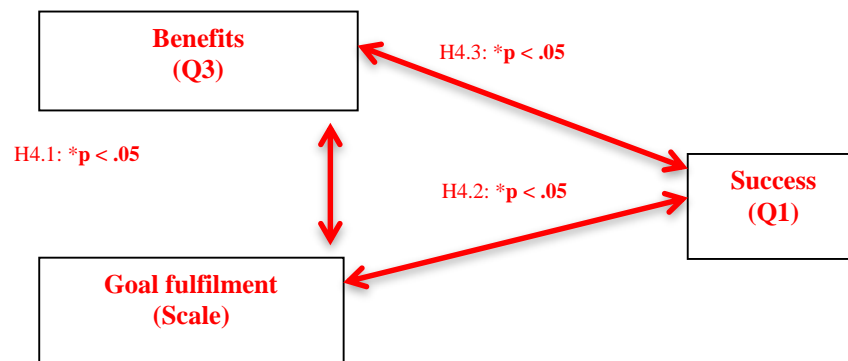


Figure 5.11: Expected associations of Hypotheses Set 4

In accordance with H4.1, a positive medium-sized positive correlation depicts a mutual increase in positive evaluations of eHealth benefits when goal fulfilment is also positively evaluated, and vice versa (Table 5.8).

Table 5.7: Bivariate correlations of Q1, Q3, and scale of goal fulfilment

Survey question	N	Mean	SD	Q1	Q3	Scale
Q1: Overall implementation success	55	3.7	1.24	--		
Q3: System benefit	58	4.3	1.0	.11	--	
Q9: Scale: goal fulfilment	41	3.8	.93	.29*	.33*	--

Note: All reported correlation coefficient are based on Kendal's Tau, two-tailed, with $p^* < .05$.

Perceived strategic goal fulfilment is statistically associated with the opinion about implementation success: the more strategic organisational goals are judged to

be targeted during the implementation, the more the implementation is evaluated as positive. Remarkably, the previously non-significant association of each single targeted organisational goal of patient safety, patient-centeredness and efficiency (see Table 5.6) with success perception becomes significant when compounded into a single indicator. Comparing the scatterplots of the particular goals with the overall scale indicator, “goal fulfilment”, suggest this is due to the diminished influence of people with extreme opinions and a more condensed distribution of the values forming a pronounced trend in the data (Appendix D, Figure 6). Thus, H4.2 seems to be supported, while the final assumed link according to H4.3/cf. H3.2 has already been refuted previously (as multivariate analyses confirm, Appendix D, section 2.3.3).

5.4 Summary and chapter conclusions

Interestingly, the non-response rate of 1/3 of all respondents to questions targeting the implementation goals (patient safety, patient service, efficiency) and the role clinicians or the eHealth department opposed to a GJNH-wide effort for implementation success, suggest some lack of clarity in implementation vision and linking that to organisational strategy. It also poses a question about the effectiveness of top-down communication around the implementation’s objectives and linking that to organisational goals and the teams involved. Nevertheless, most respondents have a clear opinion on whether or not the eHealth system implementation in GJNH has been successful. As discussed above, 72% indicated that they perceived the implementation as a success. Hence, the quantitative data from many employees of GJNH support some findings drawn from the qualitative interviews from a subsample of employees at GJNH. 86% of all respondents are satisfied with the eHealth system. Interestingly, also 86% of all respondents find the eHealth system beneficial. This points toward a congruency of perceived usefulness and satisfaction with the system. In comparison with the qualitative research conducted earlier in the research, the link between satisfaction with the system and the system being beneficial, the link here seems to be stronger. This association can also be found at a correlational level. Accordingly, the more people that are satisfied with the system, the less they indicate the system would be of no benefit to them, as

opposed to the hypothesis: “system satisfaction and benefit of the system are independent”.

Similarly, it has been noted above that there is a positive correlation between the perceived success of the implementation and user satisfaction. This confirms the findings from the qualitative research and the definitions of system implementation success in the D&M model, where one of those definitions is user satisfaction. According to the D&M model, the definition of success of information systems implementation is about system quality, data quality, use of the system, user satisfaction, and net benefits.

On the other hand, and seen in the qualitative research, some users might find the system implementation successful, yet they do not think it is beneficial. Such a distinction between the system being successful and beneficial can be seen in the weak and non-significant correlation between responses to questions 1 and 3. This contradicts the definitions of system implementation success in the D&M model, as according to these findings, the perceived success of the implementation does not necessarily indicate that the system is beneficial.

In compliance to the qualitative analyses of the interviews conducted as part of the in-depth case study, multiple factors seem to have contributed to the implementation success at GJNH. Out of the many factors, some emerged as relatively new or more significant. Those factors were used in the questions of the survey, and are listed below:

- a) a high clinician’s involvement level
- b) an organisation-wide effort
- c) clinical background of eHealth people
- d) eHealth leadership
- e) change champions
- f) national policy

As the results above demonstrate, most of the respondents think that eHealth leadership is very important for implementation success, which is probably

one of the characteristics of the implementation at GJNH. The second area, in terms of the respondents' positioning of importance, is clinical involvement. Although it emerged as an important theme during the in-depth interviews, it did not have as much weight, when we approached a larger sample. The factor, following in terms of importance, is the perception of the implementation as an organisation-wide effort, which was closely followed by the perceived importance of having change champions during the implementation. However, the deductive tests confirmed H2.1: the efforts of the leadership team should be perceived to be a more important factor of implementation success compared to the role of change champions' contribution to success. It also confirmed H2.3: the involvement of the clinicians is equally perceived to be important for implementation success, as the organisation-wide effort is essential.

Approximately half of the respondents thought that there was not any link between the implementation and the achievement of the organisation's strategic objectives, which can be explained by poor communication as above, but could also be because of the lack of such link to begin with. However, deductive tests confirmed H4.1: perceived benefits are associated with the perceived degree of strategic goal fulfilment (efficiency, safety, patient-focused), and H4.2: strategic goal fulfilment itself is related to overall perceived success. This means that the benefit is also not directly linked to success, but to goals. Accordingly, organisational goals are more abstract in people's perceptions as a concrete daily benefit experience.

The majority of the respondents did not think that the clinical background of the eHealth team had much to do with the success of the implementation. Although this theme has emerged as one of the new and interesting themes during the qualitative phase of the research, it does not seem to be a belief that is adopted by most of the users at GJNH. However, but similar with the case of change champions, the reason could be the lack of awareness of the background of the eHealth team when it comes to specialties and previous experiences. Nevertheless, inferential tests gave change champions a higher significance, which also applies to the national eHealth policy.

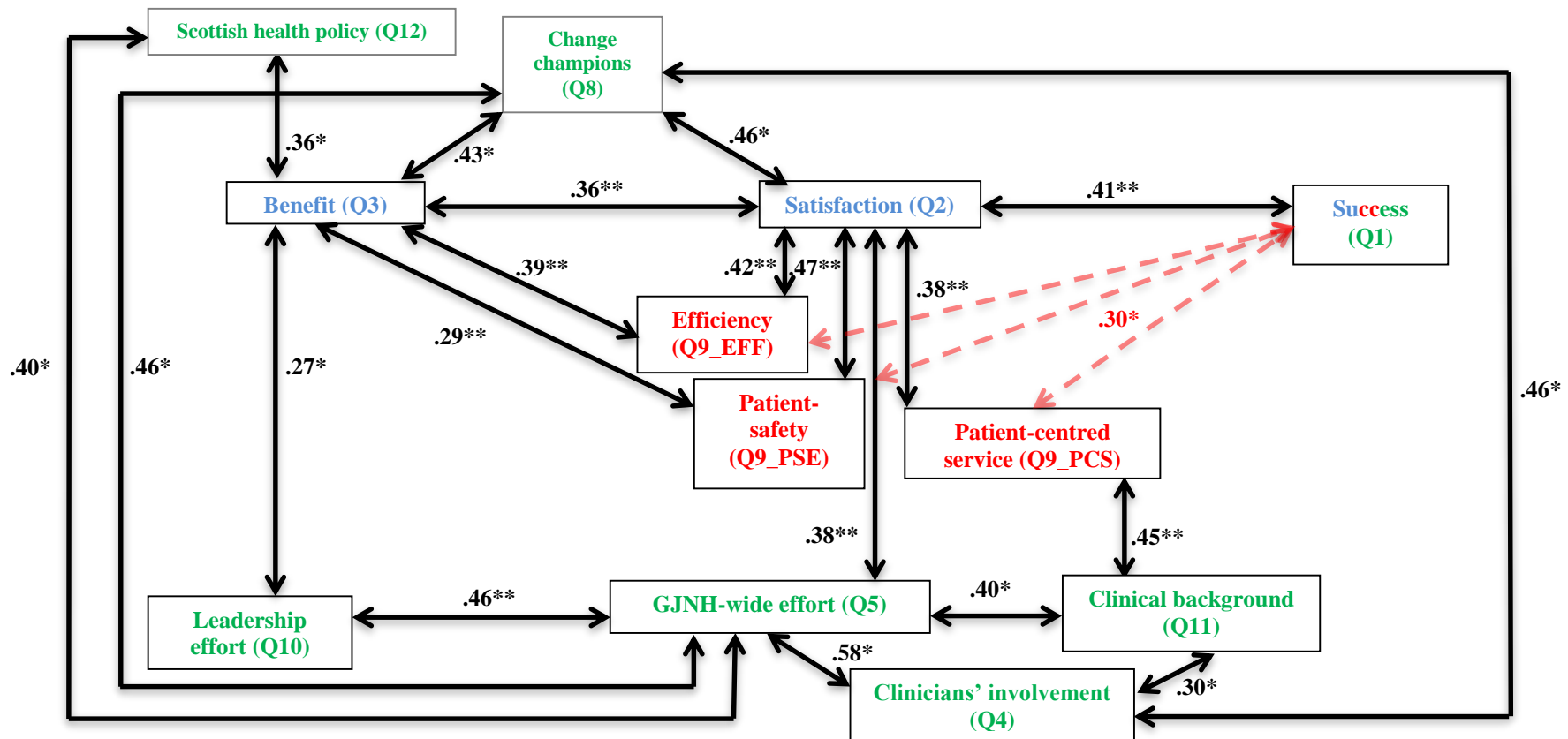
5.4.1 Incidental Comments

When it comes to eHealth training methods, unlike what is expected as a result of the interviews, face-to-face formal training is still the most popular method of training between users. Having said that, the second most popular method, which the qualitative research indicated is the new method of training, was training through peers. Following on the qualitative research result, another relatively new method came third, which is online training. Training through peer groups, which similar to training through peers, came forth in terms of popularity. Training through social networks came last in terms of importance, which indicates that this method still has a long way to go in terms of effectiveness among users. Another reason for its poor regard could be that it has not been used or introduced in the first place.

In addition to the finding above related to the qualitative findings, Figure 5.9 and Figure 9.10 are graphical representations of the results summarised in Table 5.6. They highlight the correlations that proved to be significant.

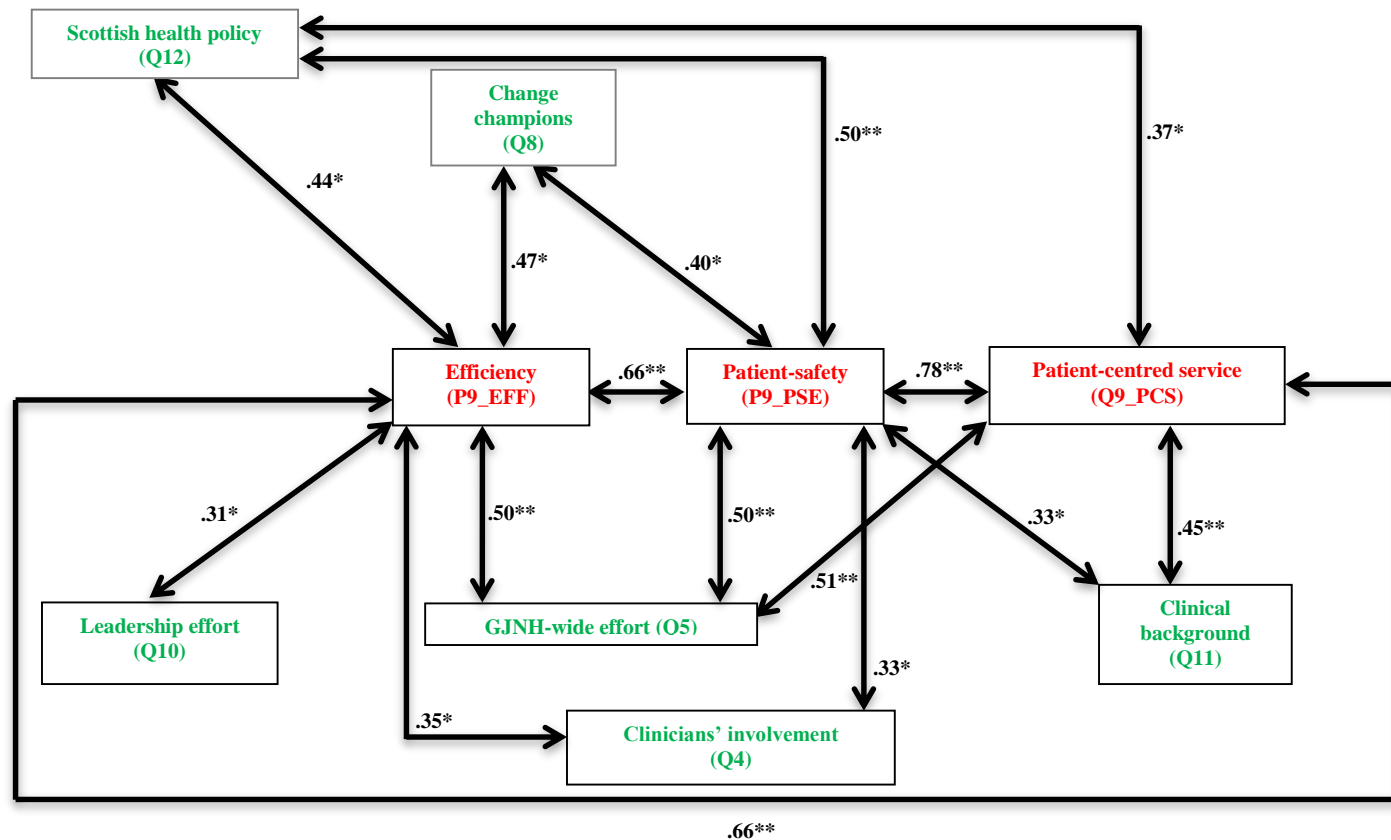
For example, it is interesting that more agreement with perceived GJNH-wide effort is related to more perceived leadership efforts and greater perceived clinical involvement and clinical background of the eHealth team (Figure 5.9). The positive relationship between the extent of agreement that Scotland's health policy affected the implementation success and the greater degree of a perceived GJNH-effort is remarkable.

Another result is the central role of all the targeted organisational goals with the perceived importance of implementation factors (Clinical background, clinicians' involvement, leadership effort, GJNH-wide effort, Scotland's health policy). These various links with targeted organisational goals and their relationship to success makes the perceived organisational goals an interesting starting point for strategically changing people's opinion about perceived implementation success.



Note: The figure *selectively* shows important relationships of respondents' evaluations. For reasons of clarity and comprehensibility, the correlations between the organisational goal variables with the other implementation factor variables (Table 1) are separately depicted in Figure 5.10. This figure's numbers represents selected non-parametric bivariate correlation coefficients found in Table 5.6. Green are variables regarding Hypotheses Set 1; blue of Hypotheses Set 3; red dashed arrow represents the significant association of all three targeted organisational goals when combined into one "goal-fulfilment scale" with overall success.

Figure 5.12: Display of *selected* results of the inferential analyses from Table 5.6 focused on the relationships between evaluations of overall eHealth implementation success, perceived benefits, eHealth satisfaction and their significantly associated variables; as well as the correlations of these significantly associated variables



Note: The figure *selectively* shows important relationships between the organisational goal variables with the other implementation factor variables (Table 1). This figure's numbers represent selected non-parametric bivariate correlation coefficients found in Table 5.6. Green are variables regarding Hypotheses set 1 and red of Hypotheses Set 4.

Figure 5.13: Display of *selected* results of the inferential analyses from Table 5.6 focused on the relationships between targeted organisational goals of patient-centeredness, patient-safety, efficiency and their significantly associated variables

CHAPTER 6. DISCUSSION

6.1 Introduction

Previous chapters discussed the growing importance of eHealth in healthcare organisations, and the main themes that were studied around eHealth and implementations of eHealth systems. Following that, the research then moved to the action of putting eHealth into practice, and the definition of success in information systems implementations. Different factors related to IT systems, leadership, individuals, and organisational structure and governance emerged, and were associated with successful implementations of eHealth. Those factors were applied in this research through qualitative and quantitative methods.

Previous chapters have also described the different research methods used in this research, and illustrated the findings that resulted from applying those methods. An explanatory case study was conducted to test the theoretical framework of the D&M IS success model and other theories in the eHealth implementation at GJNH.

The outcomes of the case study assisted the research in finding the main themes related to the level of success of the implementation of eHealth at GJNH. The findings of the case study were then used in the quantitative research phase to test them with a wider set of users. The quantitative research consisted of a survey as a method to triangulate with and quantify the main findings of the case study. This quantitative evaluation resulted in confirming some of the qualitative findings, verifying others, and rejecting some.

This chapter endeavours to understand and place in context the findings of both the qualitative and quantitative research that was conducted. By applying the framework analysis methodology on the interviews' output during the qualitative phase of the research, a number of distinctive themes and groups of themes emerged.

The original structure of the interviews focused on two main areas that resulted from the literature review as frameworks to examine and test in the case study. Those areas were the themes of the D&M model of IS implementation success, and other themes in the literature that were mostly related to other aspects of implementing IS projects, such as

project management and enterprise communications like those studied by Abdullah (2012). However, after conducting the case study and analysing the results, there were three distinctive areas that emerged, including themes around the D&M model, themes explored in the literature other than the D&M model like Abdullah (2012) and the group of new themes that surfaced from the case study interviews, but were not necessarily linked to the eHealth implementation success in the literature studied.

This chapter is therefore organised according to these three areas. The first area focuses on the D&M IS success model to examine whether or not it is suitable to evaluate implementations of eHealth. The second analyses the findings related to other theoretical frameworks. Finally, the third section reports on interesting areas that emerged from the research, which can potentially enrich the current understanding of success of eHealth implementations. For each of the three areas, this chapter will discuss both the qualitative and quantitative findings. Thus, the understanding of the success factors is enhanced, and the results are triangulated, which was one of the main purposes of using mixed methods as the research methodology in this thesis. This triangulation gives an overall better understanding of the factors that affected the implementation of eHealth at GJNH, and how this understanding can be applied in practice.

6.2 The D&M IS success model in eHealth

As highlighted in Chapter 5, the majority of the small sample of users at GJNH believes that the implementation of eHealth was a success. Overall, the case study showed that the D&M model does generally apply to the implementation of eHealth at GJNH. Having said that, there were some users that did not perceive the implementation as successful for which they expressed particular reasons related to specific areas like system quality or information quality. However, most of the users perceived the implementation as successful and were able to relate to the D&M implementation success definitions. Those definitions seemed to be applicable to the implementation of eHealth at GJNH. Most importantly, and for each success criteria of the D&M model, users at GJNH identified specific criteria that contributed to each aspect of the main criteria, like system quality, for example. Some of those specific criteria were eHealth implementation specific. Those criteria and the constructs emerging from the GJNH case study are detailed in Table 4.1.

6.2.1 System quality

As detailed in Chapter 4, the first success definition in the D&M model is system quality. eHealth users that were interviewed explained what system quality meant to them. All of them believed that system quality is a determinant of implementation success, and they identified different constructs related to system quality. Out of those constructs, the following were distinguished as eHealth specific:

- Supports patient care
- Makes clinicians effective and more productive
- Helps clinicians in their day-to-day job by providing information
- Delivers on the clinical strategy
- Meets the requirements of clinicians through the use of best of breed department systems
- Secures good connectivity between systems using clinical portal
- Integrates with national systems

6.2.2 Information quality

In Chapter 4, different constructs related to information quality were discussed. Most of the focus of the clinical team was around the value and accuracy of the clinical data provided by the system and how that data can improve the process of providing care and helping patients. Accordingly, the information expected from the system is eHealth related. Those can be summarised in the constructs presented by users in the list below:

- Caters for both clinical and management users
- Produces clinical outputs including operations notes, discharge summaries, clinical pathways, etc.
- Can produce more data around:
 - Clinical outcomes
 - Mortality and morbidity
- Produces management information:
 - Delivery against patient pathways
 - Waiting times

- Performance of outpatient sessions
- Performance of theatre
- Caters for monitoring uses:
 - Clinical division data
 - Subset division and related outcomes such as: clinical governance, performance, financials, rosters, utilisation of beds, and link to overall government performance levels
 - Board level aggregated data in addition to: complaints, issues with patients, performance targets, financial targets, and patient safety targets
- Contributes to patients' records nationally
- Follows standard formats and clinical documentation

6.2.3 IT service quality

Service quality was addressed from different angles through the case study. The participants agreed that the service provided by the eHealth department is of high quality. Some of the input was typical of IT service quality like response times, problem resolution timeframes, and friendliness of personnel. Other input was around GJNH specific quality of service attributes. Users talked about project managers being involved directly in solving problems, other members volunteering to train and educate users, and how the clinical background of the eHealth staff helped them in understanding the aspiration and challenges of the uses they were serving.

Another area that was elucidated is the high level of trust and respect that the eHealth department enjoys within the organisation, which allowed its leader to be an active management member in planning and executing other activities that are not necessarily related to eHealth. These actions are viewed as a superior level of service quality provided by the eHealth department. Clearly, some of those attributes of service quality are eHealth specific, which are summarised below:

- Provides personalised one on one interaction and problem resolution
- Connects and plans with clinicians
- Sets project group for each initiative

- Focuses on creating operational value for clinicians and management
- Provides education to small groups on applications' use

6.2.4 System use

Some of the individuals interviewed, especially those from the eHealth department confirmed a high-level of usage of the eHealth system. They clarified that the usage had been measured through system reports and independent surveys, which showed that 90% of the team at GJNH used the system. Other users, including clinicians, confirmed this usage and discussed how it was used.

However, one of the clinicians, who was identified as the critical champion, for reasons that will be explained in more detail later in this chapter, believed that the system usage was actually very low. He believed that only 30% to 40% of the people use the system as it is difficult to use and not intuitive for clinicians. This user was very involved in the implementations and was the main clinical champion. It seems that his heavy criticism of the system use, despite the particular reasons he gave, was mostly motivated toward pushing the standard higher, and aspiring for better quality systems, which can be easier for clinicians to use.

System utilisation also leads to factors related to adoption, which were discussed in Chapter 4. It was clear that ease of use does increase usage, which is an indicator of implementation success. Different users reacted to the system differently according to multiple characteristics of those users. For example, younger users, who are more literate in information technology, tended to use the system more. The case study resulted in eHealth specific constructs of system use, which are summarised below:

- Used to access clinical information about patients
- System is intuitive to use for older clinicians
- Successfully moves clinicians from using paper to electronic notes and documents
- Use is increased through the clinical portal
- Supports referrals, demand, and patient management
- Increased usage through engagement and giving live demos highlighting the benefits

and problems solved

- Accelerated through peer pressure where the non-users stand out

6.2.5 User satisfaction

In the D&M model, the system implementation is successful not only if the system is being used, but also if the users are satisfied. This distinction is essential, as shown by the case study results. Although not all of the interviewees were satisfied with the system, most of them did use it. For example, the critical champion was very condemnatory of the system, yet he was a champion in using it.

The survey results show that 80% of respondents were frequent clinical system users (more than once a day or once a day usage). It also shows that 86% of all respondents are satisfied with the system, which confirms the high satisfaction levels among users. Interestingly, the correlation tables of the survey results, which were discussed in detail in chapter 5, show a connection between user satisfaction and the perceived success of the implementation, which confirms the flow of the D&M model, links system usage to user satisfaction, and predicts implementation success as a factor of user satisfaction as in the arrows in Figure 2.9 (D&M in literature review).

One of the users confirmed that the main indicator of satisfaction with the system is that it is fit for purpose. Basically, systems should do what they are built to do to ensure user satisfaction. As in other areas of the D&M model, users identified eHealth specific constructs that elicit satisfaction with the system, which are summarised below:

- Solves clinicians' problems
- Delivers initiatives like tele-health
- Makes clinicians' lives easier
- Allows for on-going future integration

6.2.6 Net benefits

As detailed in Chapter 4, the case study showed that all participants found the eHealth system beneficial, even those who were not satisfied with it. The results of the

survey showed that 86% of respondents find the eHealth system beneficial, which is interestingly the same percentage of the respondents who were satisfied with system. The case study results showed that the system satisfaction and system benefits can be independent, as indicated by the fact that the critical champion believed that the system was beneficial, while he was completely dissatisfied with it. Upon testing this assumption with a larger sample through the survey, the results showed that net benefits and user satisfaction are actually correlated. This also confirms the D&M model and its linkage of user satisfaction and net benefit through arrows as in Figure 2.9 (D&M from literature review), as user satisfaction leads to net benefits in a successful eHealth implementation. The case study uncovered some eHealth specific benefits outlined below:

- Allows for single sign-in for all systems
- Improves accuracy and patient safety
- Improves patient care
- Produces useful data sets for critical governance, and society specific requirements
- Produces data for audit and Mortality and Morbidity meetings
- Produces appraisal data
- Fulfils strategic outcomes like:
 - Minimising waste
 - Making people more efficient
 - Supporting clinical decision-making
- Makes patient data available before the patient arrives to the hospital
- Standardises practice and documentation/information formats
- Increases productivity through freeing clinicians' time
- Increases referrals, meaning more patients, which makes hospital more productive
- Connects with patients through shared pre- and post-treatment reports
- Improves clinical governance
- Improves performance indicators

It has to be clear here that unlike the other constructs of other D&M categories, the above eHealth specific benefits are just examples of advantages that can be sought out or evaluated in other implementations, but not constructs of implementation success.

Therefore this list of benefits is not wholly inclusive. In this sense, other specific benefits or goals can be planned, and ultimately achieved if an eHealth implementation is successful.

6.2.7 Overall implementation success

As detailed in Chapter 4, most users found the implementation successful, and each gave their reasons for this perception. Overall, success is not part of the D&M model constructs mentioned above, but is determined and measured by them. Success, then, is the dependent variable of the other variables above. By asking about it during the case study, this research was enriched with user views of success, and how it was perceived and evaluated.

However, the presence of the independent variables of success indicated the existence of success. Similarly, the survey results indicated that 72% of users perceive the implementation to be successful. The combination of the qualitative and quantitative research shows that the implementation at GJNH was successful. It also shows that the factors of the D&M IS success model do apply to this eHealth implementation, and explain its accomplishment.

6.3 Themes in other literature related to eHealth projects

As mentioned earlier in this chapter, the survey questions were based on the established D&M IS success model, and a set of success factors encountered through a literature search and summarised by Abdullah (2012). While the case study aimed to evaluate the suitability of the D&M model as one unit that would define success in eHealth, the researcher individually chose the other success factors according to the literature research. Accordingly, they were examined one-by-one during the case study, and their validity for eHealth projects is discussed individually. The purpose was to understand the value of each factor and how it can contribute to the implementation's success.

6.3.1 eHealth vision and business plan

As detailed in Chapter 4, users at GJNH understand and relate to the vision and business plan for the eHealth implementation, which was the national vision for Scotland. This vision, and the strategy related to it, was initiated as early as the year 2000 (Pagliari,

2005). Pagliari et al. explained the initial objectives:

The Electronic Clinical Communications Implementation Programme (ECCI) was initiated in 2000 with an intended end date of March 2003, later extended to 2005. It is part of the NHS Scotland eHealth Strategy, which includes a commitment to implementing the universal patient identifier, enabling record linkage and thereby integrated electronic health records. (2005, p. 106)

The business plan was the local delivery plan in GJNH, which was updated on an annual basis and discussed in some detail in Chapter 4 by EP5. It was clear from the case study results that the availability of a vision and business plan for an implementation of eHealth is not sufficient on its own.

The commitment of top management to the vision and plan and dedication to implement them played an important role. Communicating those plans to the rest of the organisation in an effective way and getting the buy-in is an important factor in their success, which leads to an organisational culture discussion. The case study showed that the culture at GJNH was an open culture of inclusion, which facilitated getting the commitment and participation of the whole team. eHealth then became an enterprise project, not an IT project. When asked in the survey, most of the participants viewed the eHealth project as a GJNH-wide effort.

6.3.2 Enterprise communications

During an implementation of IS, different types of communication take place within the enterprise, from the leadership to the rest of the organisation, or from the project team to the wider group of users (Mair et al., 2009). As discussed earlier, the case study showed that communication is essential to activate plans of eHealth and get general involvement and buy-in. This finding complements the available literature around enterprise communications during IS implementation and diffusion of innovation.

Communication from leadership is key when implementing IT systems in a healthcare organisation. Leaders need to continuously convey their corporate strategy and align their IT goals with it. If not, the new HIT system is unlikely to be integrated (Rogers,

2003). The case study showed that communication happens in two main ways.

The first method for interaction and sharing information is the communication by the leadership and the champions they rely on, and the informal communication it generates. For example, the CEO at GJNH viewed eHealth as one of the main strategic objectives of the organisation. She consistently communicated that importance through leadership meetings, staff meetings, and her day-to-day interaction with staff. In this interaction, she preferred an informal, open-door policy, where everyone can discuss issues and suggest solutions. This informal and open method of communication was also followed by the leadership team, especially the CIO, who was part of many open discussions with different members of different teams in the organisation. The CEO also communicated the importance of eHealth through involving the head of eHealth in all strategic leadership initiatives and meetings, even those that were not specifically about eHealth. Research showed that leadership should depend on opinion leaders or champions. Health organisations should identify those opinion leaders within the medical community and communicate with them on a regular basis. eHealth adoption significantly increases when opinion leaders adopt health information systems. As Rogers (2003) confirmed, most communication among adopters of an innovation occurs within the same profession. Accordingly, healthcare organisations need to ensure vertical communication between executives and opinion leaders in the medical community.

The other type of communication used is the formal type, which is part of the project plan. As the case study explained, different channels were used to deliver the information to users, including emails, newsletter, bulletins, and formal seminars. A combination of formal and informal communications would ensure that goals or objectives were communicated effectively. At the same time, specific tasks and departmental objectives would be served.

6.3.3 Project management

The case study showed that project management was a factor of eHealth success at GJNH. Similarly, the literature, as discussed in Chapter 2, confirmed the role of project management in eHealth implementation success. The project management style was based on involvement and cooperation with users rather than enforcement, which goes along with

the organisational culture set by the leadership, and the way they communicated the implementation objectives. They took part in training, and offered help with the system whenever required. Technical aspects of project management, like project methodology, and project planning were also addressed and viewed as important.

At the core of project management is the role of project managers. Project managers can stick to their tasks of planning and following up as specified in project methodologies, or they can get more involved, and build personal relations with users as the GJNH case study shows. By doing so, project managers become more of change managers or champions. In this capacity, project managers can work closely with champions, or combine both roles. Boonstra and Broekhuis (2010) integrated the role of project leaders and champions together. They viewed the role of those leaders/champions as so essential that the lack of such an individual might cause the implementation to struggle in improving quality or achieving its goals.

Accordingly, careful attention must be given to the role and influence of project leaders/champions. Boonstra and Broekhuis elaborated:

In an EMR implementation project, project leaders/champions are the people who lead, encourage and support the change at the management level. Provided they strongly believe that EMRs will bring benefits and quality improvement, they will be willing to bear the risks and costs in order to generate the benefits. One important function of project leaders/champions is to motivate other members of a practice to participate in the change process. (2010, p. 231)

6.3.4 Change management

As explained in the literature study in Chapter 2, change management is core to implementations of eHealth and a factor of their success. In GJNH, communication and management style was a way of change management. As their organisational culture is one of involvement and openness, managing change with individuals and groups within the organisation was easier. Formal and informal communications helped as well in change management.

In addition to the communication channels mentioned earlier, there was a specialised portal site to communicate with and engage end-users. Communication should play a role in aligning long- and short-term goals with project timelines and expected outcomes, which plays an important role in change management (Mair et al.,2007). A pilot methodology was adopted, which gave the organisation the opportunity to try to experience applications in one department or with a small group. Similarly, iterative methodology contributed to change management in different ways. It got clinicians engaged in the design of application and allowed them to go through different iterations until their requirements were met. This also increased satisfaction as clinicians could see the outcomes of their efforts, and their teamwork with other groups in the organisation. Mair et al. (2007) encouraged this approach as they advocated that engagement with end-users is an essential part of this process. To target and motivate users to use the eHealth applications, the implementation team needs to continuously seek opinions and different viewpoints to promote collective decision-making and individual autonomy.

6.3.5 Implementation team structure

According to the holistic view adopted by the leadership and the rest of the organisation at GJNH, the implementation team is not the eHealth team assigned to the project only. Rather, it is a team that includes and incorporates all groups and departments of the organisation. Previously this section discussed the inclusive nature of the organisation, which means that different team members can contribute to the implementation. Accordingly, project managers, IT professionals, administration staff, senior managers, and clinicians of different specialities took part of the implementation. It also briefly addressed the role of change champions and clinicians in the implementation of which we will go into more detail later in this chapter.

6.3.6 Quality of system selection and implementation

The selection of the eHealth system followed the formal process published by the NHS. Users at GJNH think that system selection and the relationship with the system vendor play an important role in project success. The organisational culture of openness and involvement played a role in system selection and implementation. The case study showed that users from different parts of the organisation were involved in system selection, and

also in the implementation and interacting with the vendors during the implantation. The vendors, as well, had the chance to communicate openly, and attend internal meetings to get a better understanding of the organisation's requirements. This way, all stakeholders worked together as one team.

System selection has been discussed widely in information systems implementation literature in general. However, a much smaller number of studies researched the subject in the context of eHealth. One of those studies is the article by Lorenzi et al. (2009), that stressed that it is essential to clearly understand the needs of the healthcare organisation, and the features of the available eHealth systems in the market that can meet those needs. They provided eHealth specific selection advice summarised below and adopted from their list:

- Few if any ambulatory practices can develop their own system; therefore, a commercial vendor is often the likely source of the product selected. An alternative is to investigate a shared system from the healthcare system.
- Open source options such as versions of the VA Veterans Health Information Systems and Technology Architecture (VISTA) system are also now gaining momentum as are Internet-accessible approaches.
- Many vendors are stronger on sales than on support, therefore it is critical to find a vendor with a reasonably large, satisfied customer base that includes practices similar to one's own practice.
- Visiting practices that have installed the system of interest is essential to learn about the "hidden costs" and the problems likely to be encountered and the responsiveness of the vendor to problems, and to obtain advice on how to overcome common problems.
- If visiting is not possible, talk with more than one practice using the potential system.
- Ask the potential vendor to provide access to a demonstration system for all practice members to "test-drive."
- Ask all staff for their assessment of the strengths and weakness of the system as they perceive that the system would apply to the practice.

- The wording of the contract to purchase and support the system can make or break the implementation success. Base payments on achieving functional milestones determined by the practice, not by the vendor.
- The Internet provides a valuable source of information regarding specific products, capabilities, and the selection process. (2009, p. 15)

6.4 New themes that emerged from the case study

As explained earlier in this chapter and in Chapter 4, the focus of the interviews during the case study was the D&M IS success model, which defines IS success, and the success factors frequently mentioned in IS literature and is summarised by Abdullah (2012). However, during the framework analysis that was adopted to examine the case study findings, which was explained in detail in Chapter 3, new themes that were not studied earlier in the case study or literature search started to emerge. Those topics were further investigated to narrow them down into the most important themes that might have an impact on eHealth implementations. Those themes were then further investigated through the survey to explore and evaluate if they had a significant relation to the eHealth implementation success at GJNH. In addition, the qualitative research analysed the impact of each of the factors independently, and tried to link some of the factors to better understand how they interact within an eHealth implementation scenario. Those factors can potentially enrich the D&M IS model in similar scenarios. In the rest of this section, those additional factors are discussed in light of the findings from both the case study and the survey findings.

6.4.1 Clinical involvement

The case study results showed that clinical involvement was a theme that was dominant in team member responses regardless of whether or not certain questions were specifically asking about it. As discussed, clinical involvement is a theme unique to eHealth implementations, and although it is not new in relation to its effect on successful change management in healthcare (Mair et al., 2009), and had been addressed by different research, it is still interesting as it interacts with many aspects of eHealth implementations. Clinical involvement was an essential factor throughout the implementation life cycle from designing new systems, to getting the buy-in of the clinical community, to implementing

systems that are user friendly and productive for clinicians, to change management and encouraging system use, all the way to training. The survey results confirmed the importance of clinical engagement. It came second to eHealth leadership, although with a large difference between the two in terms of the numbers of participants who found it important.

Clinical involvement was also highlighted in the literature, and the roles of clinical staff within implementations that were discussed, were similar to the ones that resulted from the GJNH case study. Clinical involvement was mentioned in different studies as one of the recommendations for better adoption and implementation of the eHealth system.

Rozenblum et al. covered this area in their list of recommendations:

To increase adoption of electronic health records, strong clinical and administrative leadership will be needed, as will a cadre of clinicians trained in medical informatics to bridge the gap between information technology and health care. (2011, p. 281)

In successful implementations, senior leaders set goals related to encouraging the engagement of clinical teams with IT staff during and after the implementation (Murray et al., 2011).

The involvement of users and clinical staff in particular is important in the design and deployment of the system. The system use is affected by how user friendly it is, which is reached to a major extent through clinical engagement in the design. This engagement is achieved through nurturing close partnerships between the designers of eHealth applications and end-users, as its end-users are most acquainted with the setting in which the new application will be utilised. The iterative process of testing of prototypes with different groups of end-users and redesign of initial and future releases ensures continuous fit of the designed applications with end-users' expectations, and systems' objectives, which will help in change management and stimulating adoption (Cresswell & Sheikh, 2009). Mair et al. highlighted clinical engagement as one of their main recommendations for eHealth implementations: "Formalised mechanisms need to be put in place to ensure the establishment of an on going three way dialogue between designers, implementers and professional users" (2007).

Clinical involvement was also studied in the context of iterative development, which was mentioned under change management above, as a way for both a successful design and implementation of the system, and satisfaction of clinical staff. Pagliari highlighted the importance of understanding the iterative approaches within healthcare professionals, as its implementation as a development model can result in the success of eHealth initiatives through the involvement of medical workers. She explained:

Similarly, models of user-centred design bear a close resemblance to iterative models such as Action Research and Continuous Quality Improvement...These also conceive of a cycle or series of cycles through which users' needs are assessed, interventions developed, problems identified, and changes made to the intervention or the management of its delivery. Indeed, these models are advocated within both the health care and software development arenas. (2007, p. 8)

Lately, clinical engagement has been acknowledged as one of the main success factors in the implementation of eHealth. However, there is still a lot of research required around the best ways of clinical engagement, roles, plans, timelines, and impact. In their research around factors that promote or inhibit the implementation of eHealth systems, Mair et al. (2012) conducted a systemic review on the relevant literature to identify those factors. They identified 'ways to engage with healthcare professionals' as one of the main gaps that requires more imperial research to be understood and applied in practice.

6.4.2 eHealth leadership

The role of the leadership in the eHealth implementation at GJNH was clear. It was given credit for success in different aspects like the local delivery plan, the culture of openness and involvement, actively participating in eHealth projects, and in rewarding success as a way of motivation and change management. The role of leadership was also acknowledged in the literature as explained in Chapter 2.

The different and potentially interesting aspect of leadership that emerged from the case study is eHealth team leadership, meaning the leadership of the eHealth department. Users at GJNH, from all backgrounds, related success in the eHealth implementation in

conjunction with the eHealth team leadership. They discussed leadership in the way the implementation team was built, the communication with clinical team and top management, the quality of the eHealth department services, and the role in making and implementing national eHealth strategies. The head of eHealth was regarded as a trusted member of the team in each department. He attended management meetings and departmental meetings that discussed issues completely independent from eHealth. The CEO also recommended that he sit on clinical committees, including those that are purely clinical. In this paradigm, eHealth becomes an integral part of the organisation, not only an IT department that deals with systems and machines. As the literature recommended, such a relationship will reduce the resistance to new systems, and improve the quality of the implemented systems as they are built through active participation and cooperation between different departments.

The survey results also confirmed the observations of the case study. The role of eHealth management was viewed as the most important aspect of the implementation success. Out of all respondents to the survey, 92% viewed eHealth leadership as essential for the implantation success. This fact about the eHealth implantation at GJNH highlights the clear importance of this subject in relation to eHealth success. It is indeed one of the recommendations of this research that this aspect of implementation is studied further to determine the characteristics of the eHealth leadership, background, suggested strategies, and engagement approaches.

6.4.3 Critical champions

As discussed in the literature summary in Chapter 2, the role of champions is important in eHealth implementations, although a bit less than half of the survey respondents realised the role of the champions in implementation success, which is possibly due to the unclear role of champions since they work between different groups, and they do not have official roles or titles as champions. Nevertheless, such champions are major influencers and advocates. Mair et al. think of champions as enthusiastic advocates whose actions can influence the implementation positively or negatively: "... being enthusiastic advocates, could legitimise and promote enrolment and commitment of colleagues or alternatively by negative actions could jeopardise the commitment of staff needed to make

the system work and thus impede implementation” (2007, p. 123).

The champion identified by the case study has many of these characteristics identified by Mair et al. (2007). He is enthusiastic, opinionated, and a strong advocate of eHealth. The case study showed that he was active in regional clinical bodies planning for eHealth. He also participated in the design and implementation of the system; he encouraged others to use it, and trained them when needed. He is a medical physician, and at the same time, a major technology enthusiast who has specific views on how companies should develop software, and how user interfaces should look, suggesting new uses of technology within healthcare. All those characteristics correspond to those analysed by Gagnon et al. (2010), who focused on the qualities and characteristics of champions in eHealth implementations. Their qualitative research showed the vital importance of a clinician that combined wide knowledge of information systems with leadership skills recognised by his colleagues, who viewed his presence as a champion as the most important factor in the implementation success. His role as both a champion and a leader in the organisation impacted the decision that led to the success of the project. Gagnon et al. (2010) further described the roles and characteristics of the required champion in eHealth implementations, which are summarised in Table 6.1 below.

Table 6.1: Roles and characteristics of the champion (Gagnon et al., 2010, p. 35)

eHealth Champion	Attributes
Roles	<ul style="list-style-type: none"> • Building a bridge between developers and users • Participation in applications’ design • Key role in decision-making • Knowledge transfer • Technical support
Characteristics	<ul style="list-style-type: none"> • Super users of applications (technical skills) • Leader • Entrepreneur • Trainer

However, in the case of GJNH, the champion had another role. He was the most outspoken critic of the system. He was the only interviewee who thought that the system was not user friendly. Hence, it was not being used. He was also the only interviewee who believed the eHealth implementation was not truly successful. All of the above led this research to call him the ‘critical champion’. He demonstrated high challenge and high engagement at the same time. The critical champion has been very enthusiastic about the

effort he put into the eHealth system, yet he criticised it very aggressively. This leads to an assumption that such behaviour is based on the champion's aspiration of highlighting the weaknesses and the negatives, so they are resolved faster. Demonstrating this effort, the critical champion would be pushing the eHealth implementation forward through the means of putting a great deal of effort into it, yet at the same time, consistently exposing its downfalls. This style of 'championing' eHealth implementation is worth exploring further to get a better idea on how eHealth would function in practice, its potential affects, and ways of harnessing its effectiveness. Accordingly, one of the most valid points of learning from this research would be that implementations need to identify this cohort amongst clinical users.

6.4.4 Organisational culture

The case study findings showed that the philosophy of GJNH is centred on patient care. The leadership showed commitment to advancement and innovation, and expressed competitiveness by aspiring to be the best in adopting eHealth in the hospital's operations. Different responses showed an overall culture of openness and practicality. In such culture, the CEO's door is open to receive other team members for unplanned meetings, the head of eHealth participates in different meetings and groups even if they are not related to eHealth, and the eHealth team members voluntarily drop by users' offices to train them on using the system. All interviewees indicated that those were factors of implementation success. In a similar fashion, the survey results showed that the wider audience in the organisation believed that eHealth was an organisation-wide effort, not an IT effort, alone, and they believed that this team strategy was a success factor.

Such findings at GJNH are confirmed by the literature. Organisational culture has an affect on eHealth implementations' success and potentially its benefits. An innovative and open-to-change culture can assist in the success of eHealth. Such culture is categorised as being a culture of exploration, experimentation, collegiality and participation (Gagnon et al., 2010). Gagnon et al. elaborated, "The state of organisational readiness for change not only affects the computerisation of the medical record, but also everything that it involves in terms of changes in the ways of working and operating modes" (2010, p. 31). Accordingly, the culture of the organisation was one of the success factors at GJNH. It is therefore

interesting to study the affect of organisational culture on eHealth success, and to potentially use the guidance of the organisational dynamics in GJNH implementation for other similar operations.

6.4.5 Innovation in eHealth training

Users at GJNH, specifically the critical champion, believed that eHealth systems should not require any training, and that user interfaces should be so effortless to work with that users will not need any training. He shared his experience with one of the applications built at the hospital, and how its design and ease of use required no end-user training. If those objectives were not entirely achieved, the second best would be to use more effective modes of training away from formal classroom training, like online training, training through peers, or training through social networks.

eHealth training has not been widely studied independently. Nonetheless, it was often addressed in case studies and national evaluations as a contributing factor to eHealth implementations. In one of those studies an implementation champion similar to one at GJNH identified some innovative methods of eHealth training other than classical classroom training. Gagnon et al. described the use of those ‘train the trainer’ methods of on the job training in addition to the innovative methods used by the implementation champion:

He has prepared training videos on many applications that are accessible to team members... in ensuring knowledge transfer to the various players involved in the project. He therefore developed a progressive and tailored training program (available electronically) and periodically presented communications at meetings involving users. (2010, p. 35)

Similarly, Jossif et al. presented different implementations and categorised their success or familiarity according to their training activities. They also identified different training methodologies: “... ranging from classical approaches like train the trainers, using demo cases followed by personal training, group training, workshops, to more recent methodologies based on eLearning sessions including teleconsultations. The training was carried out successfully in all cases” (2007, p. 9). They went on to identify training as “a critical factor in achieving this is training of the physicians, the paramedical and

administrative staff in emerging information technologies in healthcare. Training of these personnel should include concepts like electronic patient record, web-based systems, security, teleworking, and others” (2007, p. 10). Their study took place in Cyprus where they highlighted that the WHO recommended investing in eLearning methods, and providing wider access to digital libraries in addition to activating evidence-based research within eHealth, and participating in the establishment of a network to share experiences internationally (Jossif et al., 2007). Similarly, Finland used innovative methods of eHealth training: “Televideo-conferencing for education was maintained by 20 out of the 21 hospital districts, 32% of the health centres and two from among the sample of 28 private service providers” (Hämäläinen, 2009, p. 50).

Although the methods above seem to be noteworthy explorations and indicate the achievement of similar benefits, when it comes to eHealth training methods in GJNH, the top preference was formal training. Having said that, other methods started to gain popularity as 22.4% of users thought that training through peers is the most effective method, and 17.2% preferred online training. Training through social networks, which was suggested by the implementation champion, received the interest of only around 2% of the respondents. This means that eHealth training is moving away from formal classroom training to more hands-on methods, but the pace and effectiveness are still to be explored further.

6.4.6 The national aspect of eHealth implementations

eHealth strategies has become a main focus of different governments worldwide, this focus reflected the solutions that eHealth can potentially bring to some of the chronic issues in healthcare systems around the world. This is one of the reasons why understanding success in eHealth is important (Black et al., 2011). More specifically, understanding the role of national strategies in such success is important for government to take action that could enhance the prospects of it.

GJNH operates as part of the NHS of Scotland. Users explained that the Scottish NHS is more of a ‘culture of convergence’, as they put it, with reference to their eHealth strategy and delivery of care in general. It is a ‘loose-tight’ strategy where the government sets the

standards, lines out general strategies, and leaves it to hospitals and trusts to design and plan their own individual delivery plans. It is widely believed that this strategy is one of the factors behind the success of eHealth in Scotland. According to the leadership, this model is preferred over another model based on central planning and implementation like the one followed in England. To make sure there is still cooperation and collaboration between the different hospitals, different national committees were set up. Knowing that not all users in GJNH are involved with the national strategy and the local delivery plan, for 34% of all respondents to think that the health policy of Scotland is one of the success factors is an indicator of the general awareness of this aspect.

Searching related literature, the WHO stressed the importance of eHealth on the national health agenda of different nations. This importance is amplified because of the challenges discussed earlier in the literature, like funding, and the need for the health delivery system to be more efficient (Global World Health Organization, 2012). eHealth has a major impact on the health delivery ecosystem and its impact is summarised by the WHO in Table 6.2.

As discussed earlier in the chapter, in large developed nations, major legislation was passed, large budgets assigned, and national projects were initiated for eHealth. Sound examples of such projects are the eHealth initiatives of the UK (Jones et al., 2005) , and US (Swayne et al., 2012).

In low-income nations, partnerships around eHealth can be one of the few available ways for implementing eHealth with the existing pressure on human and financial resources. Those partnerships can be with the private sector, international organisations, and the development agencies. Such a solution is not without challenges, including cultural differences and geographic distances, miscommunication and misunderstanding, maintaining funding and momentum for initiatives, and lack of consistent basic services such as electricity and Internet connectivity (Tierney et al., 2010). In many instances, eHealth has more impact in developing nations than in developed nations: “Because of the lack of infrastructure and backup systems in resource-poor environments, well-designed e-health solutions may have a much larger impact on quality of care than in more developed

areas” (Blaya et al., 2010, p.251). To achieve the required impact of eHealth in developing countries, the public sector has to play a pivotal role, and cooperate and coordinate with the private sector and academic research institutions (Rodrigues & Risk, 2003).

Small, developed nations seem to have gone through major progress in eHealth. Denmark is regarded as one of the global leaders in the integration of eHealth into the healthcare delivery on a national level. Since the 90s Denmark has been a pioneer in eHealth legislation and in driving the eHealth agenda across public health providers. They also focused on integrating systems to provide a nationwide integrated eHealth platform (Kierkegaard, 2013). Similarly, The Netherlands was one of the first countries to have a national eHealth system. There was a major focus on the area of legislation and information security and privacy (Dumay, 2007). Sweden started its eHealth initiatives in 2000, and has managed to implement a national patient record, prescribing system, and has contributed to eHealth efforts across nations like the Baltic eHealth initiative (Olsson & Jarlman, 2004). In Finland, the initial national eHealth strategy was developed in the mid 90s. Since then, there have been many achievements, especially on the fronts of patient empowerment, establishing electronic health record standards, and sharing of medical information across healthcare organisations (Doupi & Ruotsalainen, 2004).

There seem to be higher chances for smaller advanced countries to make better use of eHealth, than those of larger countries. Stroetmann et al. conducted a study on eHealth across Europe and stated:

The survey results suggest that in large countries the complexity of national EHR systems is very difficult, if not presently impossible to be managed and controlled. Experience so far shows that regions or countries with more than 5 to 10m inhabitants tend to encounter very protracted or even initially failed implementation attempts, particularly when they do not feature a top-down healthcare system. (2011, p.11)

With regards to this thesis, the research case study was conducted in Scotland, which fits the criteria of a small nation in the mentioned pan-European study. The nation size in this case allows adopting national strategies without falling into the complications

mentioned earlier. MM6 made such a comparison during the interviews, when she mentioned that the eHealth strategy in Scotland avoided the mistakes made in England. She highlighted that in Scotland the standard and eHealth requirements were set centrally, but different regions and trusts were given the freedom to choose the best way of implementing the standards, and achieving the requirements, which is what the users identified as a culture of convergence. Stroetmann et al. similarly highlighted the importance of having a central government entity that coordinates and ensures the establishment of a national eHealth infrastructure:

Unless a (public) regional or national health institution exists, service providers usually do not have an incentive to establish such an infrastructure, i.e. we face a so-called market failure situation where this ‘public good problem’ can only be solved by government intervention. To compensate for market failure and allow this network effect to kick in, adopting a ‘public good’ perspective of eHealth infrastructure investments seems to be adopted by more and more countries. (2011, p. 12)

Table 6.2: National impact of eHealth (Global World Health Organization, 2012, p. 3)

Stakeholders	Impact of eHealth
Citizens	<ul style="list-style-type: none"> • Enables personalized care, throughout the health system and across the lifespan • Makes health care available at home, at work or in school – not just the hospital or clinic • Focuses on prevention, education and self-management • Facilitates reaching out to peers for advice and support
Professionals in research and practice	<ul style="list-style-type: none"> • Gives access to current, specialized, accredited knowledge for clinical care, research and public health; and to research, publications and databases • Enables communication between patients and providers • Makes high-quality distance learning for basic and continuing professional education readily available • Allows remote consultations with patients, for second opinions, and with professional networks
Hospitals, academia and public health	<ul style="list-style-type: none"> • Establishes hospitals as a virtual network of providers, connecting all levels of the system • Monitors quality and safety; improves care processes and reduces the possibility of medical errors • Assists mobility of citizens and their medical records – providing patient information when and where needed • Opens new opportunities in basic and applied research; from health knowledge to policy and action • Extends collaboration and shared computing power (i.e., grid and cloud computing) • Delivers services despite distance and time barriers • Standardizes ordering and delivery of drugs and supplies
Health-related businesses	<ul style="list-style-type: none"> • Provides health content as a commodity to the public and health professionals • Facilitates research and development of new products and services; electronic health records, information systems, and clinical registries. • Enables broad and cost-effective marketing for health products and services to businesses and governments, locally and abroad
Governments	<ul style="list-style-type: none"> • Delivers more reliable, responsive and timely reporting on public health, as health becomes

	<p>increasingly central to economy, security, foreign affairs and international relationships</p> <ul style="list-style-type: none"> • Creates enabling environments rather than technology limitations • Offers new roles for stakeholders, health professionals, authorities, citizens and others • Identifies disease and risk factor trends; analyses demographic, social and health data, models diseases in populations
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6.4.7 Strategic outcomes

As with other performance improvement activities in GJNH, eHealth was not about hitting certain target numbers, but about achieving actual benefits, which map to the organisation’s strategic objectives. All the initiatives at GJNH have to hit all three strategic objectives and prove to make the operation safer, more effective, and more patient centric. The survey results confirmed the views of management around strategic objectives. For each of the three strategic objectives, almost 70% of respondents believed that the implementation targeted the corresponding organisational goal. Interestingly, it was only this dimension of the survey that was linked through statistical analysis to implementation success. The results showed that strategic goal fulfilment mediated by system satisfaction predicts overall implementation success.

The above findings from GJNH sound very promising. However, the general literature around strategic goals and outcomes goes in the opposite direction. Black et al. reviewed the literature around outcomes and the impact of eHealth and they concluded:

Our major finding from reviewing the literature is that empirical evidence for the beneficial impact of most eHealth technologies is often absent or, at best, only modest. While absence of evidence does not equate with evidence of ineffectiveness, reports of negative consequences indicate that evaluation of risks—anticipated or otherwise—is essential. Clinical informatics should be no less concerned with safety and efficacy than the pharmaceutical industry. Given this, there is a pressing need for further evaluations before substantial sums of money are committed to large-scale national deployments under the auspices of improving health care quality and/or safety. (2011, p. 371)

Similarly, Van Gemert-Pijnen et al. talked about the mismatch between aspired benefits and actual outcomes:

The impact of eHealth technologies is sometimes questioned because of a mismatch between the postulated benefits and actual outcomes. A lack of evidence about the distinct effects of eHealth technologies on health and health care is apparent. Health care professionals are often sceptical and show little support for eHealth because technology does not seem to work for them or the benefit of their patients. As a result, eHealth technologies often face adoption problems. (2011, p. 2)

Thus, despite the general sentiment at GJNH, and celebrated benefits in the discourse about eHealth, the evidence for such benefits is lacking. Those findings, which are listed above, can point to the direction of low levels of realised benefit. They can also mean that not enough research has been conducted around the area of eHealth benefits or impact. The second option reverberates the findings from the literature search, which shows that one of the areas lacking is research of the impact of eHealth and its benefits.

6.5 Limitations of the research

In reviewing this research, four limitations were identified. First, during the three years over which the research was conducted, significant changes and advancements occurred in the field of eHealth. Second, the primary method used was the case study. In this qualitative research approach, the issue of investigator bias must be acknowledged. Third, with limitations of time and funding, only a small set of organisations were studied for this research. Fourth and last, the limitations related to applying the research methods to this research in practice. The last two limitations must address the applicability of the case study findings in this research as adequate to draw conclusions for eHealth implementations in general.

6.5.1 Changes in eHealth and environment and the global economy

In Chapters 2 and earlier in this chapter, this research highlighted how the field of eHealth is relatively new, dynamic, and fast changing. Although this research constantly received the latest literature in the field, there is always the risk of overlooking some major contributions, or some advancement in eHealth implementations.

At the same time, as highlighted in Chapter 2, the field has seen an outstanding

focus of governments and researchers because of the national eHealth initiatives by governments worldwide especially in the US and the UK (Black et al., 2011). However, latest updates and evaluations of where we are globally in eHealth shows that the promise of eHealth remains largely unfulfilled (Rosenmöller et al., 2014). Hence, this research is well positioned in its aim to understand success in the implementation of eHealth, which contributes to more fulfillment of the eHealth promise.

6.5.2 The role of the researcher in the study

In case study based research, the researcher cannot be removed from the process, and with the theory of reflexivity in mind, should recognise the bias that he brings to the interviews and observations. In this case, the researcher’s reflexivity is especially apparent as the researcher has been working in the field of eHealth for many years and had already established his views and understanding of eHealth implementations. As such, understanding that reflexivity indicates an awareness of a bidirectional force of understanding, the researcher’s experiences would impact his initial questions, his perceived benefits of eHealth, and his predicted outcomes of the research. Yin recommends communicating early findings from the case study to critical colleagues to “test your own tolerance for contrary findings” (2009, p. 72). In this research method, the topic and findings were discussed repeatedly early on in the process. In addition to continuously checking with the supervisors, the researcher sought the feedback of colleagues and academics during events and conferences. Definitely there was critical feedback endured during these events, but input and suggestions were mainly supportive. Below is a list of conferences attended during the period of the research, and the material presented.

Table 6.3: Conferences attended during the research

Conference	Date	Material Presented
HIMSS, US	March 2011	Research Topic
HIMMS, Middle East	September 2011	Research Topic
HIMSS, US	March 2012	Research Question
eHealth conference, Scotland	October 2012	IB Salud Case Study
HIMSS, US	March 2013	GJNH Case Study
HIMSS, Middle East	September 2013	Case findings
HIMSS, US	March 2014	Survey Findings

The discussions and feedback have provided an unbiased assessment of the research, thus improving the consciousness of potential researcher bias. This process highlighted the importance of success definitions in addition to success factors at the beginning of the research. As the researcher comes from the eHealth industry and is familiar with implementations, his initial focus was on success factors in implementations, and how they can be analysed and generalised. The feedback of peers and academics steered the research to define success in eHealth first, and then evaluate the different success factors. After that, the researcher studied IS implementation success, and decided to base the research on the theoretical framework of the D&M IS success model.

6.5.3 Limitations of time and funding

Since this research began in 2011, the researcher has conducted a number of interviews, two case studies, and a survey, which are revealed in this thesis. However, because the DBA involvement and this thesis took place while the researcher was fully employed, time constraints limited the number of healthcare organisations and case studies that could have been analysed to further develop this thesis. All the interactions with organisations involved in this research, including Manchester Business School, were at countries and locations other than the place of residence and work of the researcher, which put more pressure on time and funding needed to complete the research.

Given the limitations of both time and funding, a key challenge that must be addressed is whether the findings from this case study can be extended to other healthcare organisations implementing eHealth. Two main points should be restated here to address these potential limitations. First, this research is based on a case study strategy and followed the generalisation justifications listed by Yin and other scholars, which was detailed in the methodology chapter. As in Chapter 3, it is important to reiterate the power of the well-conducted single case study to offer analytic generalisations and to provide insights that are capable of having reach beyond the organisation under scrutiny. Such case studies are needed as Greenhalgh et al. put it “We need fewer grand plans and more learning communities. The onus, therefore, is on academics to develop ways of drawing judiciously on the richness of case studies to inform and influence eHealth policy, which necessarily occurs in a simplified decision environment” (2011, p. 534). At the same time,

the overall methodology followed the mixed methods approach, which allowed the triangulation of qualitative findings of the case study with the quantitative findings of the survey. Second, there is evidence, which was discussed in the literature review, that the topic of eHealth implementations continues to grow and has only begun to be established as a topic of interest for research, which gives every new study a chance to contribute to available research in eHealth implementations, and improve the current understanding of its definitions and factors.

6.5.4 Limitations of related to the implementation of the research methods

As discussed in detail in Chapter 3, this research was designed following the mixed methods approach. One of its major components was an in-depth case study, and another was a survey. In implementing those methods, certain limitations can be observed. The case study included 12 interviews, which were the main source of case study findings. It also identified only one 'critical champion', which was the source of the role that was identified and discussed earlier in this chapter. Similarly, there were a limited number of participants that were interviewed for each of the professions within the hospital. Such limitations in numbers of participants might pose some questions about generalisability. The survey also had some challenges in the number of the respondents, which was 58 out of 250 registered system users, although it did pass the statistical test as a sample size. We also saw, in Chapter 5, that survey participants did not respond to all questions. The response rates to the questions related to change champions and the national eHealth policy were relatively low. Similarly, we saw in Chapter 5, that some of the subgroups, like the group of IT professionals, were represented by a small sample size.

As detailed in section 3.4.2 of the methodology chapter, this research has set a goal to achieve construct validity, generalisability, and reliability as per Yin (2009). It also worked on triangulating the findings of the case study with the findings of the survey to complement analytic generalisability of the findings. Finally, case studies seem to be one of the few suitable methods of studying eHealth. Even if statistical or theoretical generalisation is not achieved, other types of generalisation can be, as Greenhalgh et al. concluded:

Detailed analyses of the fortunes of individual programs, articulated in such a way as to illuminate the contextualized talk and action ("language games") of multiple

stakeholders, offer unique and important insights. Such accounts, portrayals rather than models, deliver neither statistical generalization (as with experiments) nor theoretical generalization (as with multisite case comparisons or realist evaluations). But they do provide the facility for *heuristic generalization* (i.e., to achieve a clearer understanding of what is going on), thereby enabling more productive debate about eHealth programs' complex, interdependent social practices. (2011, p. 533)

6.6 Chapter Conclusions

The case study at the GJNH and the quantitative research that followed showed that the D&M IS success model is suitable for eHealth implementations. The case study resulted in eHealth specific constructs that can be added to the D&M model when adopted in an eHealth context. A set of success factors that resulted from the literature search was also tested within the eHealth implementation at GJNH. The results explained how different success factors interact within an eHealth implementation.

Finally, the case study resulted in a set of themes that were not initially addressed by the researcher. Those themes gave a better understanding of success in eHealth implementations. They also highlighted factors that require further research to determine their value in contributing to the success of eHealth implementations.

CHAPTER. 7 CONCLUSIONS

7.1 Introduction

This chapter emphasises the main sections and findings of this research in summarising the earlier chapters discussed throughout this thesis. Chapter 1 explained the concept of eHealth and the research objectives for the project, which was to test the applicability of the D&M IS success model for implementations of eHealth. Next, Chapter 2 presented a summary of the literature on eHealth as a field of study and its main themes, IS success models, and factors affecting implementations in eHealth, sustainability, and outsourcing. The D&M IS success model was explored in detail as a guide for the research.

Chapter 3 explained the research methodology, and the case study approach was established as the main research technique, within which both quantitative and qualitative methods were deployed to answer the research question. This approach was then used in the pilot case study, and the main themes in the eHealth implementation at GJNH were explored in Chapter 4. In the case study, the main success definitions for the D&M model were applied, in addition to the success factors that emerged from the literature. The initial applicability of the D&M model and success factors was achieved. Moreover, other emerging themes and findings were discussed. In Chapter 5, the survey method was applied to verify the themes and findings of the GJNH case study, and explore further relations between the themes and constructs.

Chapter 6 discussed the findings from both Chapters 4 and 5, and connected the outcomes. The eHealth specific constructs of the D&M model were identified, and the applicability of the different success factors, in practice, were explained. This chapter also discussed the themes that emerged from the case study, and their value to enrich theory and practice, in addition to listing potential limitations of this research. Finally, this brief, summative chapter discusses the contributions of this research to practice and theory. Conclusively, it will also suggest potential areas for future study.

7.2 Contributions

This thesis is offered to satisfy requirements for a Doctorate of Business

Administration (DBA) degree. The aim of the DBA is to apply management theories to solve real business issues. Per se, this section will presently discuss contributions in terms of management practice. Following that discussion, it will also consider theoretical contributions.

7.2.1 Practical contributions

Practical contributions from this research can be categorised in three areas. First, contributions are made for planning of and setting the goals of eHealth implementations. Second, contributions are made for the organisations going through implementations of eHealth. Third, the research contributes to eHealth implementation evaluations.

7.2.1.1 Practical contributions for the planning phase

For healthcare organisations, it is important to understand what success of the eHealth implementation means. Knowing what would make an execution of eHealth successful will allow those organisations to set goals for the implementation, and manage working towards those goals. For example, following the D&M model, implementers of eHealth would aim to deliver a system that has good quality and generates superior data. The initiator would want to make sure that they provide a good service to manage and maintain the system; they want to make sure that the system is adopted, being used effectively, and that the users are satisfied. Finally, the person bringing in the eHealth system would want to make sure that the portal delivers some benefits that it was originally set up to deliver, like saving clinicians time, and improving data accuracy. For each of those general goals, there would also be sub-goals that define each of the categories. Hence, system quality would mean a stable system that does not fail often, is easy to use, and is easy to access. This research verified whether or not such categories and sub-categories apply to eHealth implementations, and added some eHealth specific constructs, which were presented in Chapter 6.

Using those eHealth constructs, system quality would also mean one overarching system so clinicians would not have to log in to different clinical systems, for example. Referring to data quality, system quality would mean following standards in coding data, ensuring that clinicians can easily interpret data, and generating data that would facilitate

the composition of reports required by health regulators.

Based on the findings of this research, organisations planning to implement eHealth solutions should consider the following:

- Study and understand the national eHealth strategy, if any, or the national or regional eHealth environment and how it can affect the implementation at your healthcare organisation.
- Build the local delivery plan base to meet the national eHealth objective, and deliver the goals of your eHealth implementation.
- The eHealth delivery, in general, should be sponsored by the CEO, and each eHealth initiative should be sponsored by one of the executives.
- Select an overall clinical sponsor of the project who is respected within the clinical community.
- Select a number of 'critical champions' as identified in the research. Those champions will be an integral part of the implementation as they will be the link between the clinical community and the information systems' specialists, yet they will highlight any mistakes or shortcomings, and always aspire to make the implementation better.
- Select an eHealth department leader who has deep experience in IS systems, the healthcare industry, and who is respected by both groups.
- Staff the eHealth department with members that have diverse backgrounds, which include information systems, and clinical familiarity.
- Collect the quality objectives required throughout the organisation, using the base of the D&M model.
- Identify the gaps in the process and the problems that the eHealth system is expected to solve.
- Based on the identified requirements, and the improvements aspired, set clear, measurable implementation goals.
- Use subject matter experts to translate the requirements and the project goals into a scope document with detailed features.
- Plan a procurement process using the scope document and following best practices in

terms of tendering and selection.

- Balance the scoring of the solutions evaluated based on the scope document according to:
 - The match between the scope and the solutions' features.
 - The ability to deliver and implement.
 - The track record and reputation of the solution provider.
- Include live demonstrations attended by different groups in the organisation based on their specialities in the selection process.
- Also, include visits to other sites where the evaluated solution is running successfully.
- Ensure that the vendor team, once the solution provider is selected, becomes part of the healthcare organisation team; communication with them should be open and continuous.

7.2.1.2 Practical contributions for the implementation phase

During the enactment of the eHealth initiative, there are different factors and activities that will affect the success of the implementation, and lead to achieving the success definitions highlighted above, or otherwise not achieving some or all of them. The success factors, which were generated through the literature search, and verified through the case study and survey, provide guidance for implementers on how to approach eHealth implementations. For each of the success factors, eHealth specific guidance was identified. For example, Chapter 4 went through the details of how national strategy was adopted for hospital implementations, how communications from leadership was handled at GJNH, how project management interacted with the rest of the organisation and change was managed, what the role of change champions included, and how implementation teams were built. The guidance from the case study can be used by similar organisations that endeavour to implement eHealth. This research also highlighted eHealth specific success factors, which emerged from the case study and survey and which can also be used by similar healthcare organisations. Success factors and themes to consider were detailed in Chapters 4 and 6. An example of those factors would be clinical involvement in the eHealth implementations, its dynamics, and challenges. Another example is the role of change champions in eHealth implementations, and the role of what this research called the 'critical champion'. National

elements that empower eHealth implementations, organisational culture that support eHealth implementations, and creative methods of eHealth training were also discussed.

During the implementation, the healthcare organisation can consider following the guidance listed here which draws from the learning from this investigation:

- Plan and implement a complete communication strategy, which includes leadership communication about the implementation, its objective, and how it links to the strategic objectives of the organisation.
- Diversify the communication channels, including billboards, emails, seminars, and workshops.
- Follow an open door policy and allow team members to share their aspirations and input in relation to the implementation.
- Set up a project management office, which follows standard methodology, like Prince 2.
- Encourage the project manager office to communicate with the vendor resources and internal resources directing the implementation.
- Build a change management team, which includes the leadership, critical champions, and the eHealth department. This team should communicate the implementation stages and the changes associated with them.
- Engage clinicians from all specialities in the implementation, and choose a clinical champion from each speciality or team to communicate with his or her peers on the system design, requirements, and the best way to use the eHealth portal.
- Use open communication during the implementation and encourage users to raise their issues and concerns.
- Use clinicians in system training during the implementation.
- Build a mechanism to track user feedback and revert it to the implementation team.
- Diversify user training to include classroom instruction, on the job training through clinicians and the eHealth team, and online guidance.
- Assess progress and overall goal achievement up until project conclusion.
- Recognise contributions and celebrate success.

7.2.1.3 Practical contributions for eHealth evaluations

It has been a clear concern that eHealth implementations must be evaluated to understand their success and otherwise change their course. As discussed in the literature, eHealth has been a growing phenomenon that consumed large amounts of human and financial resources, which means that it has to be properly evaluated to make sure those resources are deployed in beneficial way. Black et al. make this point clear:

It is equally important that deployments already commissioned are subject to rigorous, multidisciplinary, and independent evaluations. In particular, we should take every opportunity to learn from the largest eHealth commissioning and deployment project in health care in the world – the £12.8 billion NPfIT and the at least equally ambitious national programme that has recently begun in the US. These and similar initiatives being pursued in other parts of the world offer an unparalleled opportunity not just for improving health care systems, but also for learning how to (or how not to) implement eHealth systems and for refining these further once introduced. (2011, p. 31)

Since national implementations aim at implementing eHealth in all relevant healthcare facilities, the first step of evaluating national programs of eHealth is to evaluate implementations at the hospital level. The D&M model and its success definitions applied in this research can form a base to evaluate eHealth implementations. Such implementations can be evaluated against each success criteria, and the sub-criteria and constructs under them, according to their applicability. This research highlighted eHealth specific constructs under each criterion, which can also be used to evaluate eHealth implementations, and their different features.

7.2.2 Theoretical contributions

The methodology Chapter (Chapter 3) discussed, in details, Critical Realism and its suitability for IS research. This research study has shown that CR is a particularly suitable philosophical base for eHealth research as per Table 7.1. Using CR lenses and theoretical components, multiple findings were uncovered, and a number of conclusions and significant relations were revealed.

Starting with objects and entities, a set of organizations were identified, including the Scottish NHS, GJNH, national clinical committee, national IT committee, and the vendor organization. Within those entities, different groups of people continuously interact to deliver the eHealth system. Those groups are the management, the clinical team, and the eHealth team. Accordingly, different fundamental relationships are existent, some were within GJNH, and others were between organizations, like those; between GJNH and Scottish NHS, and between GJNH and vendors. Within those relations, different prominent attitudes were observed, including but not necessarily limited to; cooperation, transparency, knowledge-sharing, accountability, engagement, flexibility, and alignment. Different groups of resources were applied, for the purpose of this project, including; human resources, financial resources, and the physical infrastructure. During the implementation, various innovative ideas were generated and deployed, like; the exemplar iterative development process, the involvement of clinicians and champions throughout all the phases of the project, and the reliance on both, formal and informal communications.

As part of the implementation, causal powers and liabilities were revealed. The NHS developed the national eHealth strategy. GJNH adopted the national strategy and developed its LDP. Management put the plan into execution, and assigned responsibilities to different departments and stakeholders, and the eHealth department executed the implementation, and orchestrated the efforts of different groups within GJNH. In doing so, the management deployed a flat hierarchy as a structure, and promoted an open and inclusive culture. Cross-disciplinary task-forces were formed to deliver the requirements of the implementations.

As a result of the implementation, a number of events took place. For the end-users (clinical staff), the way the care is provided got improved, and their job satisfaction rates were raised. The improved provision of care also affected the management team, and of course, their roles and responsibilities. In addition, the management team cherished and capitalized on the increased rate of knowledge generation and exchange, heightened visibility and in turn increased ability for evidence-based decision-making, and improved efficiency and effectiveness of the delivery of care. The GJNH organization attained an improved work environment which improved job attitudes of clinical and management staff.

This in turn, improved the quality of service administration, management, and provision, and raised satisfaction rates of patients. Of course, the patients, as a result, received significantly improved quality of care, and were ultimately more satisfied with the service provision. For the Scottish NHS, the implementation led to an increased generation and exchange of knowledge, heightened visibility, and significantly improved wellbeing and quality-of-life of the population.

Several structural characteristics of the GJNH affected the overall success of the implementation, including; flat hierarchy, inclusive culture, and low-distance authority. In addition, the cross-disciplinary taskforces, which were put together for the purpose of the project, played a crucial role in the management, administration, delivering, and monitoring and evaluating of the performance of eHealth. Three entities, namely; management, clinical, and technical staff, and the constructive relationships and interactions between them stood out to be of supreme importance for the project success.

In terms of the context, the study revealed a set of important moderating variables that greatly contributed to the success of implementation. At the national level, two variables smoothed the implementation of the system; the release of the Scotland's eHealth strategy, and the existence of a visionary, action-oriented head of the national eHealth committee. As for the organizational level, to start with, the transformation of the GJNH from a private to a public organization necessitated several organizational changes, among the most prominent ones was the adaption of a system that would contribute to the national eHealth strategy and its corresponding goals. In addition, the appointment of a visionary CEO, who enjoys a deep-rooted belief in eHealth, and a CIO, who happens to be one of the national pioneers of eHealth, both facilitated the overall process. Last but not least, the prominent surge in the adaption of new IS products constituted a major opportunity that the GJNH chose to capitalize on.

In an attempt to depict the sequence of events, it is worth mentioning that the successful implementation of eHealth (dependent factor) can be traced back to several key independent factors. These factors include, a reliable national strategy that is in alignment with the organizational strategy and in turn the eHealth strategy; reliable organizations and

structures within GJNH; the effective development and enforcement of the LDP; a visionary CEO; a capable (informed and well-experienced) CIO; budget availability; effective selection of the “right” IS product; and a reliable sustainability plan.

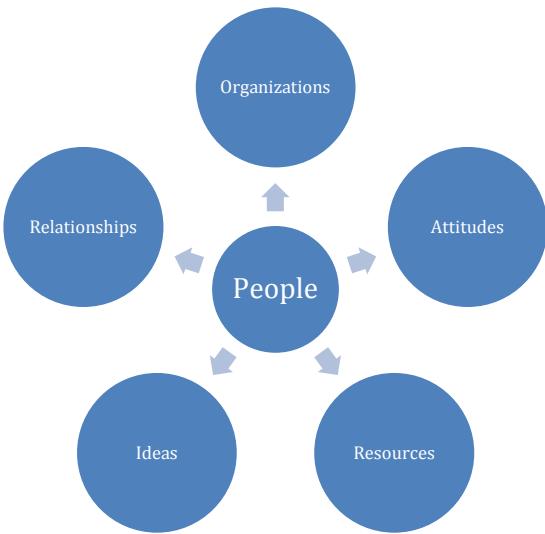
Throughout the implementation, various entities, by means of their powers and liabilities, acted and caused particular events. To start with, the management communicated the LDP, and the project’s strategy, strengths and benefits, and overall objectives. The eHealth team communicated the intricacies of the project and its operational plan. Clinical staff and eHealth team formed and activated the delivery team. The delivery team, under the supervision of the eHealth, implemented the system and executed the project. Finally, the leadership and management, and clinical and eHealth staff monitored and evaluated progress, and ensured project sustainability.

From an epistemological perspective, it is established that eHealth success cannot be measured or counted. Hence, for the purpose of this study, as mentioned earlier, observable factors were identified and set as indicators to measure the success of the implementation. A reliable research design, and a set of rigorous research methodologies were triangulated and effectively deployed to confirm the appropriateness of the previously identified parameters, assess the success of the implementation, and uncover additional fundamental characteristics that contribute to the overall success of the implementation. Despite their recognized added-value (theoretical and practical), the findings of the study entailed a part, which is characteristically provisional. This is primarily due to the research design selected (cross-sectional case-study). Therefore, follow-up longitudinal studies, where more than one implementation experiences are compared and contrasted, would help in confirming the causal relations, identified in this study, and would lead to results that are relatively more generalizable.

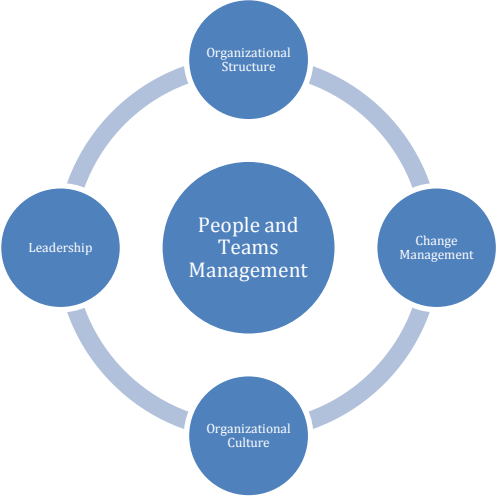
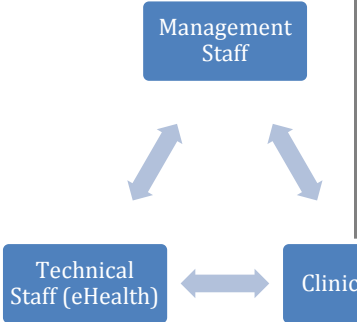
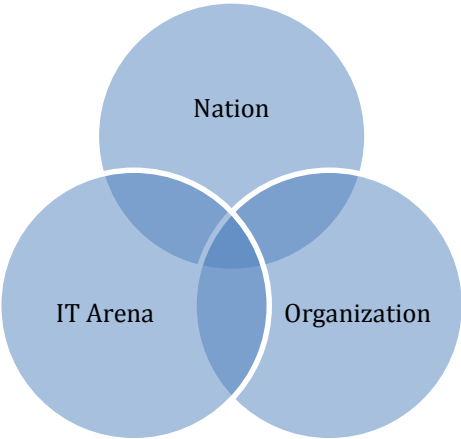
In terms of the research process, which constitute a major component of the CR philosophical platform, the importance and impact of eHealth was deductively studied using the lens of the existing D&M model. After confirming the suitability of using the generic D&M model to investigate the success of implementation of eHealth, in specific, qualitative data collection methods were relied on to thoroughly and extensively explore the myriad of

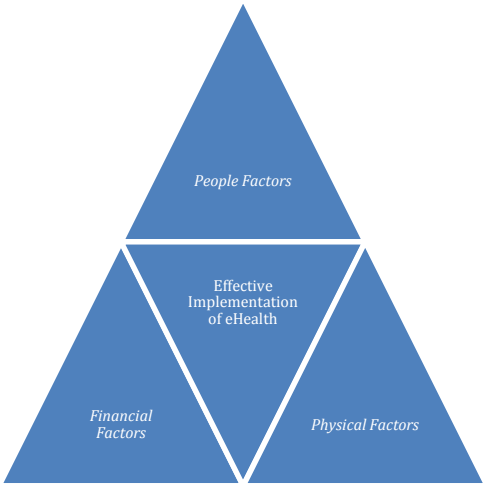
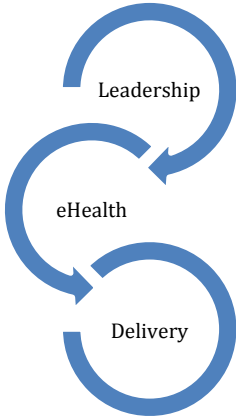
dimensions of eHealth, within GJNH. A vivid set of definitions and factors were generated and inductively analysed, and in turn mapped onto the abovementioned pre-existing model. In fact, the analyses built-on the existing model, adapting it to the intricacies of the eHealth context. The particular effect of each of the identified parameters, in the overall hypothesized success, was determined using quantitative measures. Accordingly, a holistic provisional framework was generated to suggest the interplay of all the factors, and the interdependence/ interrelationship across some of them, all of which significantly contribute to the overall success of the eHealth implementation.

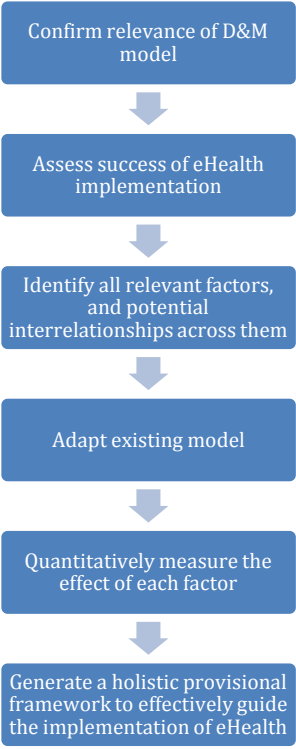
Table 7.1: Using the key components of Critical Realism philosophy, adopted from Easton 2010, pp. 120-123, to delineate the intricacies of the overall research study

Critical Realism Component	Description	Components Expected	Components Identified
Objects / Entities	Basic theoretical building blocks, such as organisations, people, relationships, attitudes, resources, MIS, inventions, ideas	 <pre> graph TD People((People)) --> Organizations((Organizations)) People --> Attitudes((Attitudes)) People --> Resources((Resources)) People --> Ideas((Ideas)) Relationships((Relationships)) --> People </pre>	<p>Organizations:</p> <ul style="list-style-type: none"> • <i>Major</i>- NHS and GJNH • <i>Others</i>- The IS vendor, and the IT and clinical chambers associated with the NHS <p>People:</p> <ul style="list-style-type: none"> • <i>Technical</i>- eHealth staff • <i>Management</i>- CEO, CMO, and CIO, and Project Managers • <i>Clinical</i>- End-users <p>Relationships:</p> <ul style="list-style-type: none"> • <i>Intra-organization</i>- Between management and clinical staff, and eHealth, and clinical and management staff • <i>Inter-organizations</i>- Between eHealth, and the vendor and the NHS governing body <p>Attitudes: Cooperation, transparency, knowledge-sharing, accountability, teamwork, engagement, participation, flexibility, adaptability, strategic thinking, harmony, and alignment.</p> <p>Resources:</p> <ul style="list-style-type: none"> • <i>Human</i>- Management, Clinical, and Technical (eHealth staff, including but not limited to; the champions) • <i>Financial</i>- Budget • <i>Physical</i>- Infrastructure, and IT (hardware and software) <p>Ideas:</p>

			<ul style="list-style-type: none"> • Iterative implementation method • Involvement and engagement of clinical staff • Assignment of champions • Formal and Informal communication channels
Causal powers and liabilities	Causal power is the ability of an entity to make things happen; a liability is a susceptibility to the action of other entities		<ol style="list-style-type: none"> 1. NHS developed and communicated the national eHealth strategy 2. GJNH developed the LDP, in alignment with the national eHealth strategy, and put it into action 3. Management assigned all necessary roles and responsibilities 4. Departments (within GJNH), under the guidance of the organizational eHealth, developed the delivery plan and executed it 5. eHealth intervened, as the need arose, to make the delivery effective and sustainable
Events	Outcomes that the critical realist investigates (i.e. the external and visible behaviours of people, systems and things as they occur, or as they have happened)		<ul style="list-style-type: none"> • <i>Clinical staff (end-users)</i>- Constructive changes in the provision of care and improved job attitudes • <i>Management staff</i>- Constructive change in the provision of care, improved job attitudes, increased generation and exchange of knowledge, heightened visibility (i.e., increased ability for evidence-based decision-making), and improved efficiency and effectiveness of the delivery of care. • <i>Organization (GJNH)</i>- Improved work environment, improved job attitudes of clinical and management staff, improved quality of service administration, management, and provision, and raised satisfaction of patients • <i>Patients</i>- Receipt of improved quality of care and higher satisfaction rates • <i>NHS</i>- Increased generation and exchange of knowledge, heightened visibility (i.e., increased capacity for evidence-based decision-making), and improved wellbeing and quality-of-life of population

<p>Structure of entities</p>	<p>A set of internally related objects or practices; for example an organisation may be considered to comprise a series of other entities such as the departments, people, processes and resources</p>		<ul style="list-style-type: none"> • Flat hierarchy • Inclusive culture • Low-distance authority • Cross-disciplinary taskforces/ teams put together to manage, administer, deliver, and monitor and evaluate the performance of eHealth
<p>Necessary relations</p>	<p>Relations that derive directly from the nature of the bodies involved</p>	<p>An interplay across the clinical, management, and technical staff.</p>	
<p>Context</p>	<p>Relevant circumstances</p>		<p>A set of moderating factors:</p> <ul style="list-style-type: none"> • <i>Nation-</i> <ul style="list-style-type: none"> ▪ Release of Scotland's eHealth strategy ▪ A visionary, action-oriented head of the national eHealth chamber • <i>Organization-</i> <ul style="list-style-type: none"> ▪ GJNH became a public organization ▪ Appointment of a visionary CEO who enjoys a deep-rooted belief in eHealth ▪ Appointment of a CIO who happens to be one of the national pioneers of eHealth • <i>Global IT Arena-</i> <ul style="list-style-type: none"> ▪ The opportunity of capitalizing on the prominent surge (hype/ wave) of the release and adaption of new IS products

<p>Structure of causal explanation</p>	<p>A formal statement of the critical realist structure of explanation using objects, structures, causal powers and liabilities. A causal explanation is one that identifies entities mechanisms that connect them and combined to cause events to occur</p>		<p>The successful implementation of eHealth (dependent factor) is traced back to several key independent factors:</p> <ul style="list-style-type: none"> • A reliable national strategy, and its alignment with the organizational strategy and in turn the eHealth strategy • Reliable organizations and structures within GJNH • The effective development and enforcement of the LDP • A visionary CEO • A capable (informed and well-experienced) CIO • Budget availability • Effectively selecting the “right” IS product • A reliable sustainability plan
<p>Mechanisms</p>	<p>Ways in which structured entities by means of their powers and liabilities act and cause particular events</p>		<ul style="list-style-type: none"> • Management communicated LDP, and the project’s strategy, strengths and benefits, and overall objectives • eHealth team communicated the intricacies of the project and its operational plan • Clinical staff and eHealth team formed and activated the delivery team • The delivery team, under the supervision of the eHealth, implemented the system and executed the project • The leadership and management, and clinical and eHealth staff monitored and evaluated progress, and ensured project sustainability
<p>Epistemology</p>	<p>Meaning has to be understood and could not be measured or counted; observation is fallible further data must</p>	<p>Strength</p> <ul style="list-style-type: none"> • Triangulation of data sources and collection tools, and research methodologies, leads to improved reliability <p>Weaknesses</p> <ul style="list-style-type: none"> • The findings of a case-study research method are not necessarily generalizable • The cross-sectional research design cannot confirm casual relationships 	<ul style="list-style-type: none"> • It is established that eHealth success cannot be measured or counted. Hence, observable factors were identified and set as indicators to measure the success of the implementation. • A reliable research design, and a set of rigorous research methodologies were triangulated and effectively deployed to confirm the appropriateness of the previously identified

	<p>be collected distinguish among alternative explanations</p>		<p>parameters, assess the success of the implementation, and uncover additional fundamental characteristics that contribute to the overall success of the implementation.</p> <ul style="list-style-type: none"> • Despite their recognized added-value (theoretical and practical), the findings, of the study, entailed a part which is characteristically provisional. This is primarily due to the research design selected (cross-sectional case-study). • Follow-up longitudinal studies, where more than one implementation experiences are compared and contrasted, would help in confirming the causal relations, identified in this study, and would lead to results that are more generalizable.
<p>Research Process</p>	<p>Retrodution, which explains events by postulating mechanisms that are capable of producing them; what produces change. Retrodution involves asking “what must be true in order to make this event possible?”</p>	 <pre> graph TD A[Confirm relevance of D&M model] --> B[Assess success of eHealth implementation] B --> C[Identify all relevant factors, and potential interrelationships across them] C --> D[Adapt existing model] D --> E[Quantitatively measure the effect of each factor] E --> F[Generate a holistic provisional framework to effectively guide the implementation of eHealth] </pre>	<ul style="list-style-type: none"> • The importance and impact of eHealth was deductively studied using the lens of the existing D&M model. • After confirming the suitability of using the generic D&M model to investigate the success of implementation, of eHealth, in specific, qualitative data collection methods were relied on to thoroughly and extensively explore the myriad of dimensions of eHealth within GJNH. • A vivid set of definitions and factors were generated and inductively analysed, and in turn mapped onto the abovementioned pre-existing model. • In fact, the analyses built-on the existing model, adapting it to the intricacies of the eHealth context. • The particular effect of each of the identified parameters, in the overall hypothesized success, was determined using quantitative measures. • Accordingly, a holistic provisional framework was generated to suggest the interplay of all the factors, and the interdependence/ interrelationship across some of them, all of which significantly contribute to the overall success of the eHealth implementation.

This research, as mentioned earlier, combines two theoretical models, including the D&M success model, which is the main theoretical framework upon which this research is based. The other is the set of success factors, which are commonly studied in the literature and were summarised by Abdullah (2012) as he investigated IS success factors in a particular healthcare organisation.

Through the case-study design, this research linked success definitions, which specify how success can be identified and measured within an eHealth implementation, with a set of eHealth success factors that surfaced through the case-study. This research examined, and in turn confirmed, the suitability of the D&M IS success model for eHealth implementations. Moreover, through the case-study design, specific factors, which contributed to the success of the eHealth implementation at GJNH, were identified. From a theoretical perspective, this study introduces a provisional framework that goes beyond the D&M IS success model, which focuses solely on mapping the particular parameters that define success of IS implementations in an eHealth setting, to further exploring particular factors that underlie the successful implementation. Accordingly, this study hypothesizes that the following factors; clinical involvement, vision and plan, enterprise communications, project management, system selection, critical champion, innovative training, organizational culture, and others, if managed effectively, contribute to the success of eHealth. Such success is determined by the D&M through the following characteristics; information quality, system quality, service quality, system use, user satisfaction, and net benefits, which were further broken down, as part of this study, into several crucial sub-categories that were summarized in Table 4.1 in Chapter 4 of this study. This framework suggests fundamental causal associations between the factors, and the definitions and their sub-categories. Thus, the interplay of the factors is potentially determining the attainment of the various components of success (as defined by the D&M). Accordingly, from an operational perspective, by intervening at the level of the identified factors, stakeholders can positively contribute to the implementation of the system.

A large number of causal associations between factors and attributes of success was identified as a result of this case-study. Potentially more associations can be identified if the model, generated from this study, is adapted in follow-up studies. Acknowledging that the

associations identified are not necessarily extensive, and that not all the relations identified can be explained, in absolute terms, it would still add value to consider some selected examples of how this provisional model explains and guides implementation, in practice.

An example, of those associations is about system quality. Users at GJNH perceived eHealth system to be easy to use. Ease of use is one of the constructs of success under system quality, as explained earlier. Those users thought that the system was user-friendly because clinicians, who are knowledgeable about and enjoy first-hand experience of how, why, and when clinicians use the system, were involved in its design. Accordingly, the study identified involvement of the clinical staff to be crucial for the successful implementation of a system that is perceived by its users to be easy to use and more precisely user-friendly. Similarly, users believed that system was user-friendly because an iterative methodology was used during the implementation phase, which allowed for collecting users' feedback at each stage or milestone, before the system was released to be in operation. The iterative methodology was another factor, which was identified as fundamental to the success of implementation and was addressed, in the provisional framework, as part of project management. Furthermore, another factor affected the perception of the system as user-friendly, which is the critical champion. The critical champion at GJNH had very strong opinions about the system usability, and the need for it to be intuitive and user-friendly. He/she gave harsh criticism about some of the existing systems and made sure that future systems will not be released unless they reach a high level of user-friendliness. This example shows how a combination of factors contributes to the achievement of the definitions of eHealth success.

Another example is service quality. System users, at GJNH, perceived the service provided by the eHealth team to be of high quality. The case-study uncovered that multiple factors contribute to the achievement of high-quality service. The clinical background of the eHealth team was identified as one of those factors. That is because their clinical background enabled them to understand the requirements and challenges of the clinical team. Moreover, the organizational culture is open and informal, which allowed the eHealth team to interact directly with users, with or without formal arrangements, and allowed the eHealth to participate in business sessions with clinical and administrative teams. Hence,

organizational culture was another important factor in service quality, which surfaced during the study. Similarly, the leadership style, of the eHealth manager, and his other relevant characteristics collectively composed a factor associated with the achievement of multiple positive attributes; one of them is service quality.

A further example is the system's contribution to the achievement of organizational goals, which is one of the attributes identified under net benefits. The availability of a mission and a business plan, which integrates the intricacies of the system and its expected impact, was one of the underlying factors that facilitated the attainment of organizational goals. Organizational culture also proved to play a role, as it was a culture of involvement, which fostered positive interactions between the users and the leadership, and across the various departments, which in turn effectively minimized the resistance to change and contributed to effectively adapting, maintaining, and sustaining the system. Another factor, in this regard, is the enterprise communication, where leadership maximized their subordinates' buy-in through consistently and continuously communicating the strengths and benefits of the system, alongside the goals of the system's implementation. Such communications were carried out through both formal and informal means. All these factors mentioned, among others, capitalized on the effective and sustainable adoption of the eHealth systems to achieve the organizational goals.

Future researchers may choose to empirically link success definitions with success factors, and produce an eHealth specific version of the D&M model, combined with success factors. In such a model, the success definition is described through eHealth specific constructs like clinical engagement. At the same time, each construct is linked to one or more success factors, which contribute to that construct's realisation. Such a model can have a stronger impact, as it will link two areas, which are currently studied independently. This research is a primary step in this direction as it commenced exploring the relationship between the success factors and success definitions through a case-study design. The case-study showed different relations, which can be verified further using more than one case or other research methods. Correspondingly, this research produced a provisional model that links eHealth success definitions and factors as per Figure 7.1.

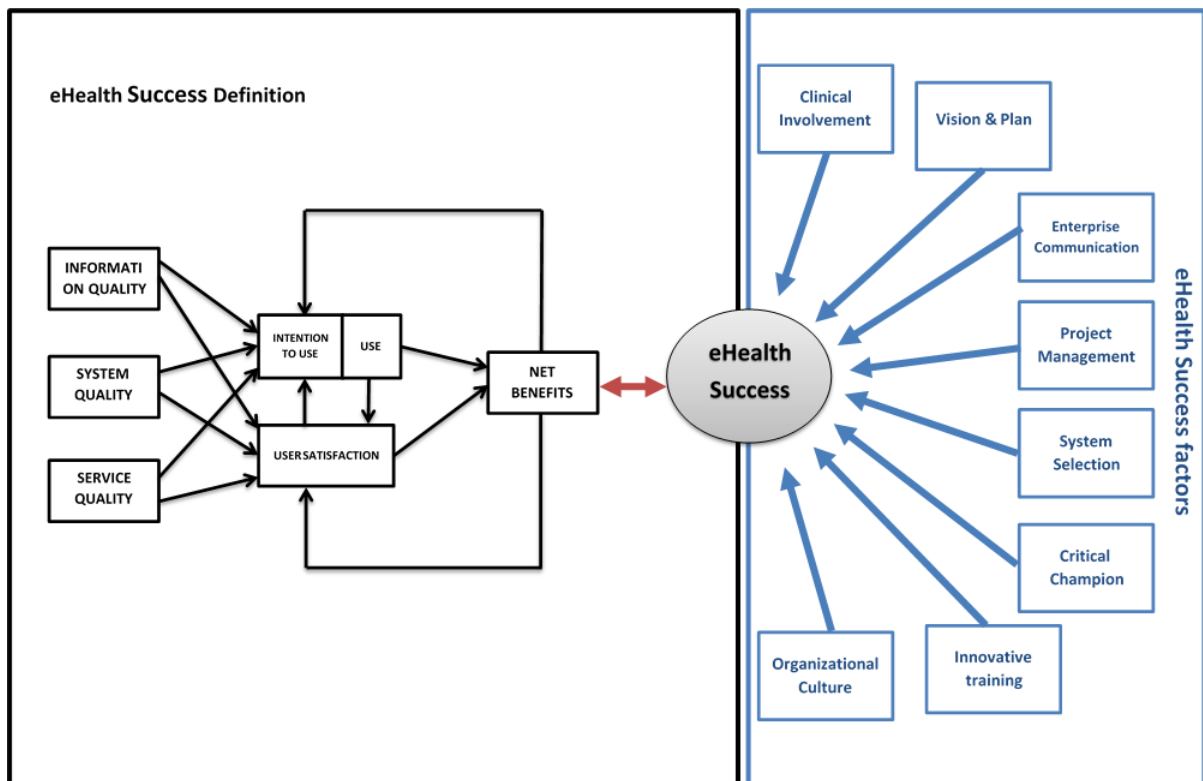


Figure 7.1: Provisional model linking D&M model and eHealth success factors.

This research showed that success in eHealth implementations can be defined by different sets of criteria, which fall under the categories suggested by the D&M model. Some of the discovered criteria were generally applicable, meaning that they apply to the implementation of eHealth or any other Information System. Such generally applicable constructs are ones like; information reliability under information quality, ease of use under system quality, and responsiveness under service quality. On the other hand, this research identified a number eHealth specific constructs of IS success. Those constructs can be added to the D&M model as eHealth constructs under each success criterion. Starting from information quality, the eHealth specific criteria describes how the information generated should improve patient care, assist clinicians in delivering, and accumulate data from different sources within the organization and on a national level. Similarly, quality in an eHealth setting is concerned with applicability for both clinical and financial users, the integrity of patients' records, the connectivity across the nation, and the compliance with standards and reporting requirements. Service quality from a specific eHealth point of view is about the availability of support for clinicians while delivering care, training clinicians, and

planning and communicating with clinicians. Consequently, when the system is used it moves clinician from using paper notes and records to using electronic notes and records, it allows access to patients' records, and it supports referrals and patient management. Users of the eHealth system are satisfied when it solves clinicians' problems, and allows for on-going integration. Finally the research identified eHealth specific constructs of net benefits. Those are benefits such as allowing single sign-in for all systems, improving accuracy and patient safety, improves patients' care, produces data for compliance, audit, and appraisal, standardizes practice, increases referrals, connects with patients, and improves clinical governance.

Based on eHealth specific criteria discussed above and detailed in chapter 6, this study suggests an eHealth specific version of the D&M model. This model represents a provisional version of the D&M model, which can be further tested and verified through future empirical research studies. Figure 7.2 details this provisional model.

Using an eHealth specific D&M model can focus the attention and effort of researchers on the specific constructs that identify success in an eHealth setting. This will open doors for further identification and refinement, and pave the way towards reaching a prescriptive model of implementation. Under such a perspective model, specific constructs and measures of success are identified. In addition, specific recommendations of factors, teams, and organizational designs that would lead to achieving success in eHealth.

This research also contributes to the theoretical discourse on the impact and outcomes of eHealth, and the relation between eHealth success and eHealth benefits. Although the findings of the quantitative research are far from generating a theory, they do contribute to this contemporary discourse. This active discussion was summarised by Black et al., who were quoted briefly in Chapter 6. Essentially, they say that there is still a weak link between eHealth implementation and the benefits expected or perceived as a result of those implementations (Black et al. 2011).

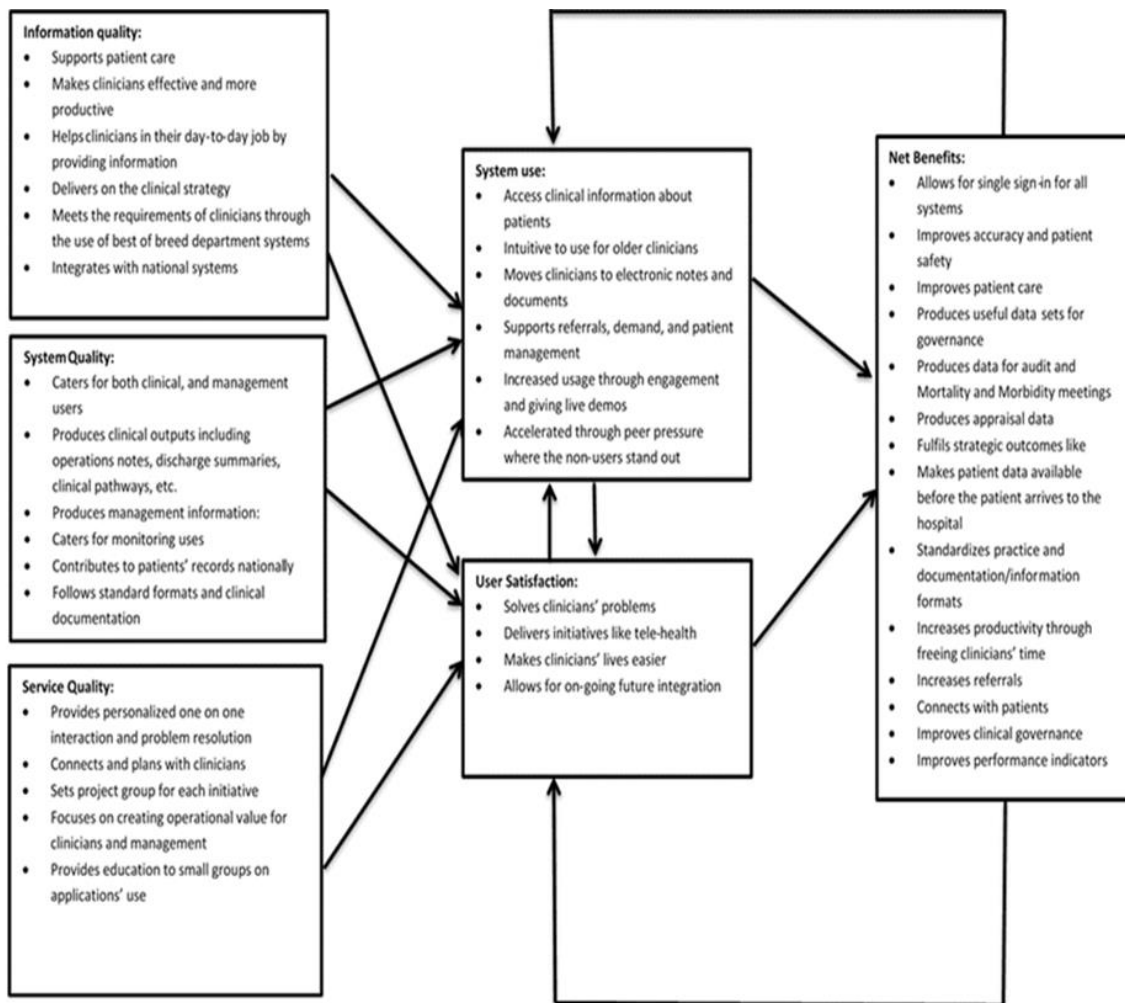


Figure 7.2: Provisional eHealth success model adopted from DeLone (2003)

7.3 Potential areas for future research

This research has only begun to scratch the surface of eHealth implementation success. As identified in the literature search, this subject is becoming increasingly important. There is a serious impact related to understanding eHealth success factors and delivering successful projects, or otherwise failing in eHealth, which has serious consequences on the healthcare industry as a whole.

Three potential areas of future study can be identified: (1) further defining success in eHealth implementation, (2) linking success definitions with success factors related to eHealth, and (3) establishing new eHealth success factors.

First, this research identified a number of eHealth specific success definitions under each of the D&M success criteria. Those definitions resulted in an adapted eHealth version

of the D&M method described earlier. However, those definitions were derived from only one case study in one hospital. Therefore, there is a need to examine this adapted model in different hospitals, and different geographies to establish global definitions of the success factors, and justify generalisability. Furthermore, each of criteria needs to be examined and defined further. For example, users at GJNH talked about system quality and mentioned the importance of user interfaces. The quality of an eHealth system, and how eHealth systems should look to meet expectations of clinicians and increase benefits, requires a lot of study and research. Similarly, the study of information quality in this research resulted in highlighting certain attributes and requirements for the data to be beneficial and serve organisational goals. Further research is required to advise on the most effective data sets, the clinical data required by clinicians, and best mediums of presentation.

Success factors also require further analysis to reach potentially descriptive models that will inform the level of application of each factor to reach the best of results. For example, clinical involvement is widely referred to in the literature and did come up repeatedly in this research. However, there is still a lot of research required around the best ways of clinical engagement, roles, plans, timelines, and impact. Organisational culture is also a subject widely mentioned in the literature. Additional research can study the affect of organisational culture on eHealth success, and how organisations can develop specific structures and culture to enhance eHealth success.

Second, more case studies and surveys can be conducted with a large number of hospitals that have implemented eHealth to establish connections between success definitions and success factors. In this research, such connections were investigated in one hospital only. Accordingly, more effort can be spent to establish stronger links. This research delivered a provisional model where it established success factors in addition to success definitions and was able to link some of them. Thus, further effort is required to empirically connect success definitions with success factors. For example, how does clinical involvement affect system quality and information quality, or how does change management impact user satisfaction? A warning has to be raised here, as discussed in the methodology chapter, about the challenges associated with finding similar health organisations with similar features, which are implementing eHealth at the same time, to be able to collect current

meaningful data that can be compared and analysed. A further aspect to consider in potential research is to reach a prescriptive stage, when specific instructions can be given to implementers, which will advise their input, which would theoretically result in specific success features within the implementation.

Third, and finally, supplementary research should focus on uncovering further success factors, especially ones that were not well documented in the literature. In this research, the concept of the 'critical champion' is an example of such a concept. More studies can be conducted to discover additional success factors, specifically ones that are more eHealth specific, or combinations of different factors and their effects within the realm of eHealth. In addition to the 'critical champion' this research also stresses the importance of studying a number of other phenomena that emerged from the case study. One of these is eHealth leadership, for which further research is required to determine its characteristics, background, suggested strategies, and engagement approaches. eHealth training, and how it can be enhanced through modern means and concepts, is another important subject for investigation. Finally, the national aspects of implementation, and how governments can accelerate eHealth success in hospitals, and what level of involvement is optimal, are all subjects that deserve further uncovering.

GLOSSARY OF ABBREVIATIONS:

Abbreviation	Term
CR	Critical Realism
CSF	Critical Success Factors
D&M Model	Delone & Mclean IS Success Model
EHR	Electronic Health Record
GJNH	Golden Jubilee National Hospital
HIS	Hospital Information System
HIT	Health Information Technology
ICT	Information and Communication Technology
IS	Information Systems
IT	Information Technology
NHS	National Health Service
WHO	World Health Organization

APPENDICES

Appendix A: List of GJNH interviews guiding questions

1. How do you rate the eHealth system quality and why?
2. How do you rate the quality of the information provided by the eHealth system and why?
3. How do you rate the quality of the eHealth department and why?
4. Do you think the eHealth system is actually being utilised by users? How do you rate that usage and what do you think about it?
5. Do you consider the eHealth system users satisfied and why?
6. Overall, is the eHealth system beneficial to the organisation and how?
7. Did the eHealth implementation have a vision and a business plan and how do you describe it?
8. How do you rate the enterprise communication around the eHealth project?
9. Was there a project management function, and how do you think it affected the project?
10. How are the implementation teams built? Did they have clinical involvement? How do you rate its effectiveness?
11. How do you describe the change management process related to the implementation of eHealth in your organisation?
12. How do you describe the quality of the technical system selection and implementation?
13. Would you say that the eHealth implementation, overall, is successful in your organisation and why?

Appendix B: List of personnel Interviewed in GJNH

Specialty Table:

Specialty	Code
Clinical	1
Management	2
IT	3

Interviewee Table:

Name	Code	Specialty Code	Role
eHealth Professional	1	3	Portal project manager
Clinical User	2	1	Chief Medical Information Officer
eHealth Professional	3	3	Team manager
Clinical user	4	1	Consultant
eHealth Professional	5	3	Head of eHealth
Management Member	6	2	CEO
Management Member	7	2	Medical Director
Clinical User	8	1	Specialist
Clinical user	9	1	Department head nurse
Clinical User	10	1	Specialist
Clinical User	11	1	Nurse
Clinical User	12	1	Nurse

Appendix C

Variable	Question	Answer option (corresponding code for analyses)
Q1	Overall, the Clinical Portal and CaTHI implementation in GJNH has been successful	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q2	I am satisfied with the eHealth systems overall	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q3	Overall, the eHealth systems are of NO benefit to me in doing my job day-to-day	strongly disagree (5), disagree (4), neither disagree nor agree (3), agree (2), strongly agree (1), I don't know (missing value)*
Q4	The involvement of the clinicians has been essential for the Implementation Success	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q5	The implementation was not an eHealth department effort only; other departments were involved when needed, and it was a GJNH-wide effort	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q6	The most suitable method for eHealth training for me is:	training through peers (1), online formal training (2), formal face-to-face training classes (3), training through social networks (4), training through peers (5), other (6)
Q7	There were change champions during the implementation	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q8	The role of change champions was essential	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q9_PSE	In the implementation, the following organisational goals were targeted: Patient safety	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q9_PCS	In the implementation, the following organisational goals were targeted: Patient-centred service	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q9_EFF	In the implementation, the following organisational goals were targeted: Efficiency	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q10	eHealth team leadership is essential for eHealth implementation success	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q11	The clinical background of the eHealth team is essential	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q12	The health policy in Scotland affected eHealth success at GJNH	strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5), I don't know (missing value)
Q13	My professional background and role at GJNH is:	medical (1), nursing (2), nursing and management (3), allied health professional (4), administrative and clerical (5), IT (6), general management (7), other (8)
Q14	I have been working at GJNH for	less than 1 year (1), 1-2 years (2), 3-5 years (3), 6-10 years (4), more than 10 years (5)
Q15	My age is	25 years and under (1), 26-35 years (2), 36-45 years (3), 46-60 years (4), more than 60 years (5)
Q16	I use the above systems	more than once a day (5), once a day (4), three times a week (3), 1 time a week (2), 1 time a month (1)

* the codes are reversed and reflect a pairing of a higher number with the perception of more benefit

Appendix D

Section 1: Survey pre-test results

The ten participating eHealth users of the pre-test can be briefly characterised as: the majority (6/10) of respondents worked for three years or longer at GJNH, while only two persons were employed less than three years. In total, respondents' ages were evenly distributed with four persons being between 26-35 years, and three persons, each, between 36-45 and 45-60. Most persons worked at the IT department (4/10); and 8/10 preferred formal face-to-face eHealth-training sessions. Remarkably, 7 out of 10 respondents used the eHealth system more than once a day.

Table 1: Employment duration at GJNH

	Frequency	Percent
Less than 1 year	1	10.0
1-2 years	1	10.0
3-5 years	3	30.0
6-10 years	2	20.0
More than 10 years	3	30.0
Total	10	100.0

Table 2: Employee's distributions across age categories

	Frequency	Percent
26- 35 years	4	40.0
36-45 years	3	30.0
45-60 years	3	30.0
Total	10	100.0

Table 3: Employees' professional background and role at GJNH

	Frequency	Percent
IT	4	40.0
Medical and management	2	20.0
Medical	1	10.0
Nursing and management	1	10.0
General management	1	10.0
Administrative and clerical	1	10.0
Total	10	100.0

Table 4: Usage frequency

	Frequency	Percent
1 time a month	2	20.0
1 time a week	1	10.0
More than once a day	7	70.0
Total	10	100.0

Table 5: Bivariate correlation coefficients (Kendall's Tau) between selected pre-test survey variables

	Q1	Q2	Q3	Q4	Q5	Q7	Q8	Q9_PSE	Q9_PCS	Q9_EFF	Q10	Q11	Q12
Q1: Overall success	--												
Q2: Overall satisfaction	.06	--											
Q3: Overall benefit	-.19	.17	--										
Q4: Clinicians involvement	-.28	.26	-.16	--									
Q5: GJNH wide effort	.15	.62	-.12	.12	--								
Q7: Change champions	.25	.56	-.63	-.32	.67	--							
Q8: Essentiality of champions	.34	.62	-.57	-.14	.77	.89*	--						
Q9: Patient safety	.75*	.39	-.15	.22	.2	.89*	.21	--					
Q9: Patient Centred Service	.80*	.4	-.29	.13	.19	.22	.37	.98**	--				
Q9: Efficiency	1.00**	.00	-.33	-.33	.15	.25	.34	.75*	.80*	--			
Q10: eHealth leadership	.66	.26	-.51	-.17	.08	.63	.57	.49	.67	.65	--		
Q11: Clinical background	.14	-.66	-.55	-.18	-.69*	-.11	-.28	-.24	-.12	.14	.37	--	
Q12: Scotland's health policy	.21	-.72*	.07	-.13	-.5	-.67	-.63	-.06	-.14	.21	-.36	.44	--

Note: *** $p < .001$, ** $p < .01$, $p^* < .05$ (two-tailed)

Table 6: Respondents' subjective indication of overall eHealth implementation success, system satisfaction and benefit in the pre-test

Survey question	N	Mean	SD	Q1	Q2	Q3
Q1: Overall implementation success	9	4.78	.44	--		
Q2: Overall satisfaction	10	4.00	1.63	.06	--	
Q3: System benefit	10	4.70	.48	.19	0.17	--

Note: no significant correlations detected at $p^* < .05$, (two-tailed).

Table 7: Respondent's subjective evaluation of multiple implementation success factors and their correlations in the pre-test

Survey question	N	Mean	SD	Q4	Q5	Q8	Q10	Q11	Q12
Q4: Clinicians' involvement	10	4.5	1.27	--					
Q5: GJNH wide effort	9	4.11	.60	.12	--				
Q8: Change champions essential	6	.67	.52	-.14	.77	--			
Q10: eHealth leadership essential	10	4.8	.63	-.17	.08	.57	--		
Q11: Clinical background of eHealth	9	3.78	.83	-.18	-.69	-.28	.37	--	
Q12: Scottish health policy	8	3.38	.74	-.13	-.50	-.63	.36	.44	--

Note: no significant correlations detected at $p^* < .05$, (two-tailed).

Table 8: Respondents' subjective evaluations of the targeted organisational goals and their correlation among themselves and with success

Survey question	Mean	SD	Q9_PSE	Q9_PCS	Q9_EFF	Q1
Q9_PSE: Patient-safety	4.63	.52	--			
Q9_PCS: Patient-Centered Service	4.5	.76	.98**	--		
Q9_EFF: Efficiency	4.75	.46	.75*	.80**	--	
Q1: Overall implementation success	4.78	.44	.75*	.80***	1.00***	--

Note: N = 8, *** $p < .001$, ** $p < .01$, * $p < .05$, (two-tailed).

Section 2: Main survey results

2.1 Descriptive figures and tables

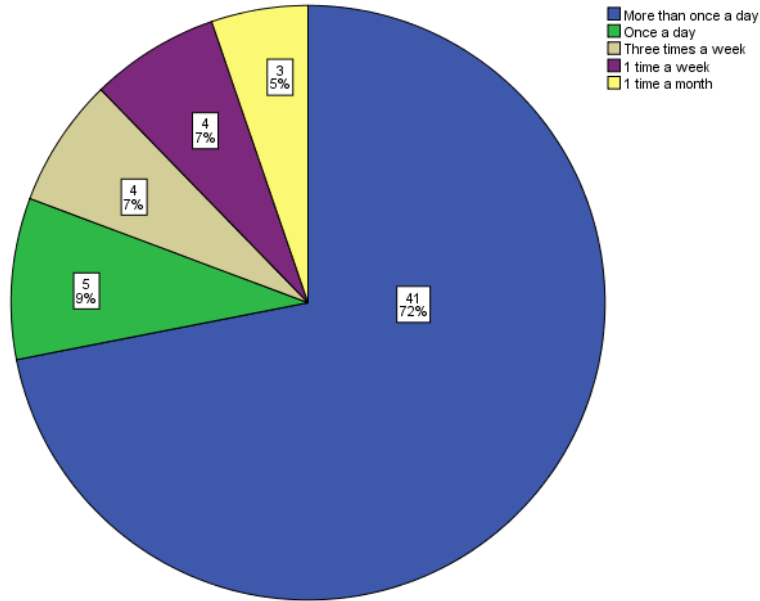
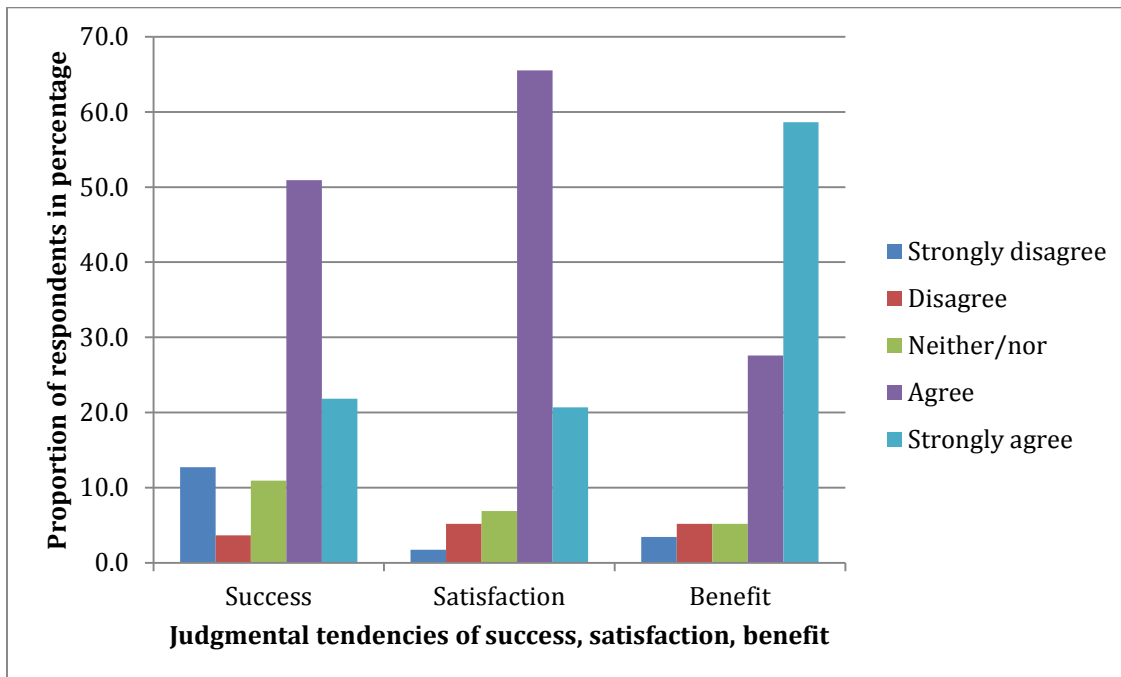
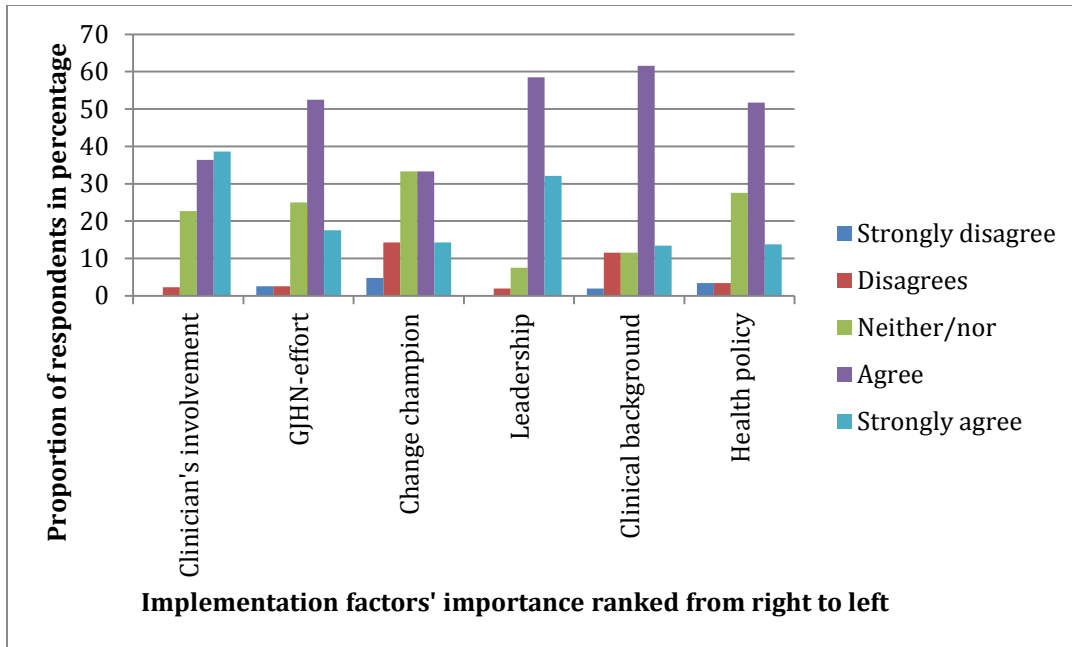


Figure 1: eHealth system usage frequency in frequency and percentages



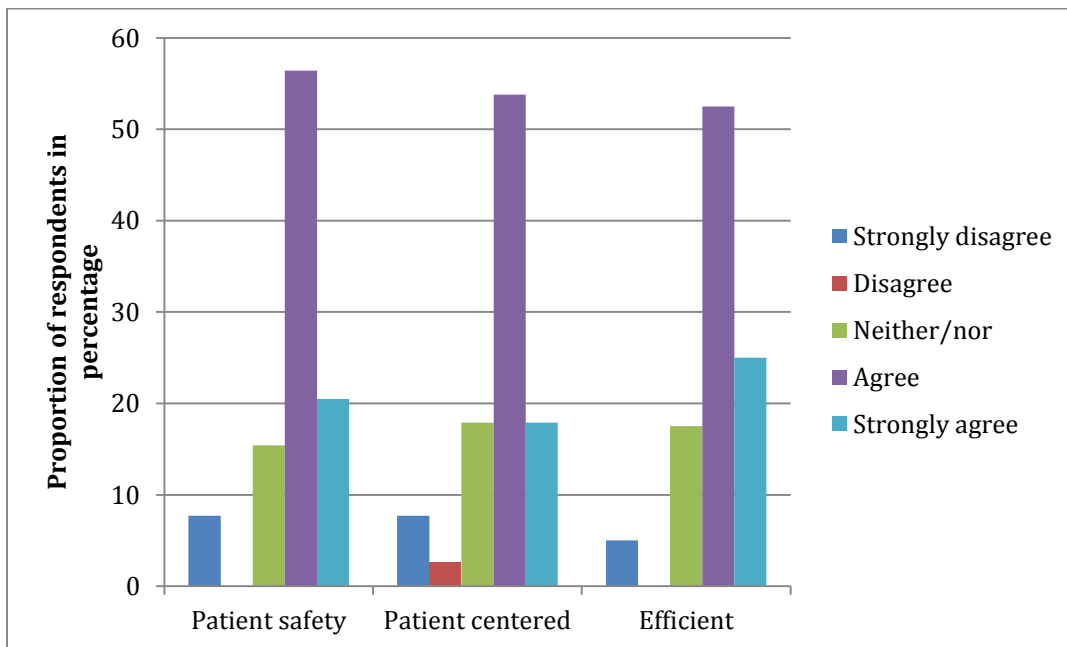
Note: $N_{\text{success}} = 55$, $N_{\text{satisfaction}} = 58$, $N_{\text{benefit}} = 58$; the original variable Q3 “no-benefit” was reversed to represent a variable capturing the “benefit” of the system for the sake of interpretation.

Figure 2: Non-collapsed evaluation of eHealth implementation success, system satisfaction, and daily system benefits



Note: $N_{\text{leadership}} = 53$, $N_{\text{involvement}} = 44$, $N_{\text{background}} = 52$, $N_{\text{wide-effort}} = 40$, $N_{\text{health policy}} = 29$, $N_{\text{champions}} = 21$

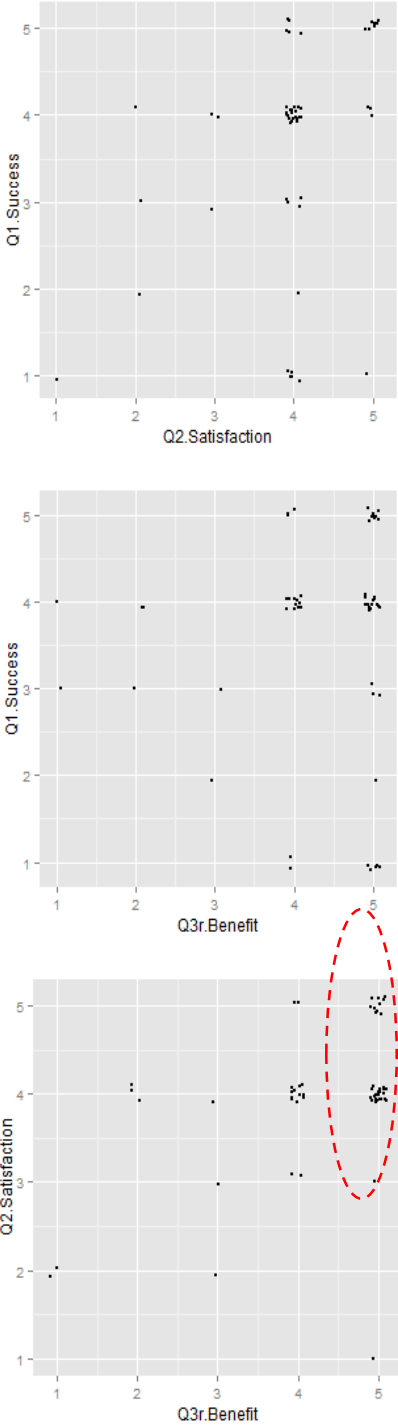
Figure 3: Non-collapsed evaluation of respondents' perceived significance of multiple implementation factors for eHealth success (unranked)



Note: $N_{\text{patient-safety}} = 39$, $N_{\text{patient-centeredness}} = 39$, $N_{\text{efficiency}} = 40$

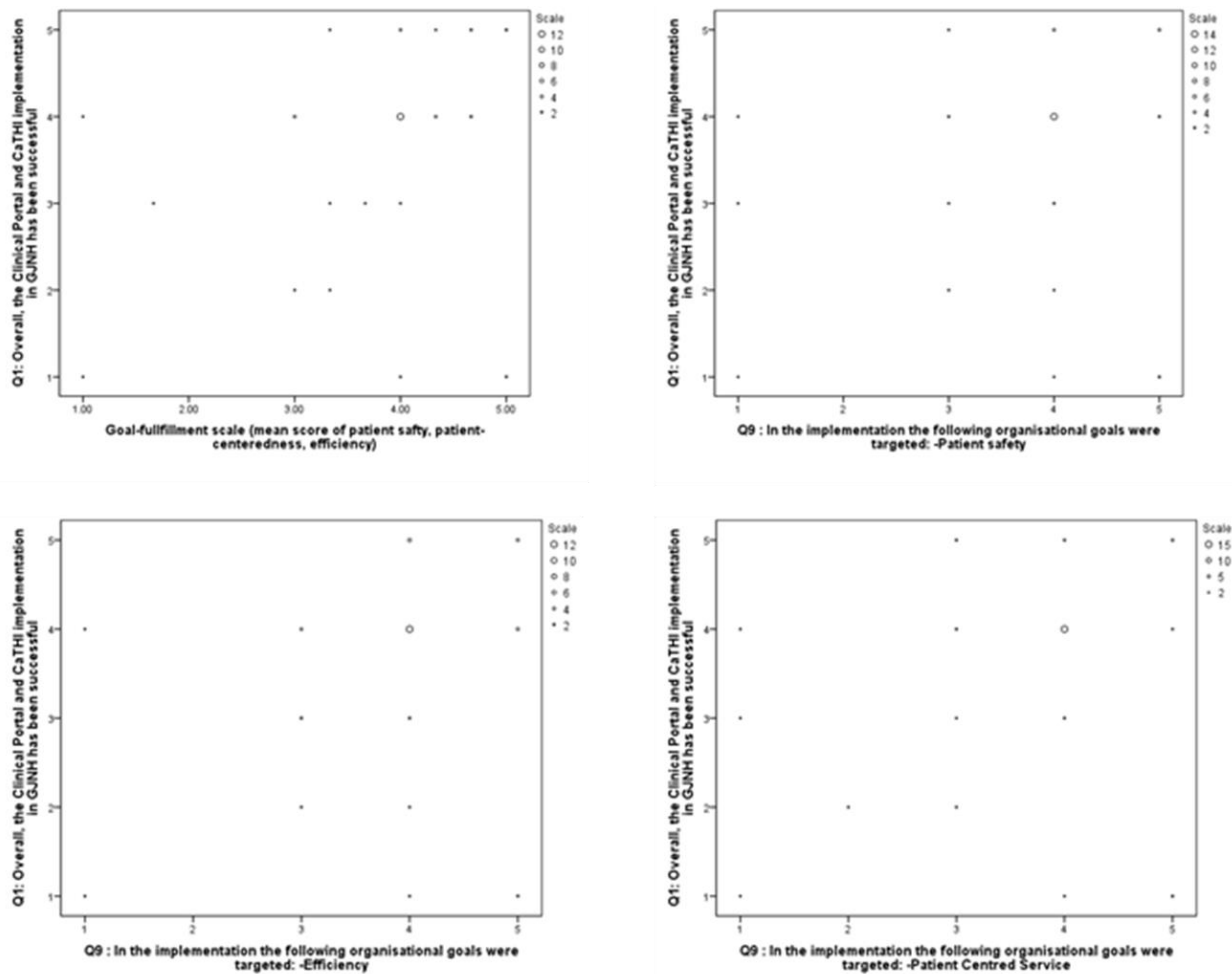
Figure 4: Non-collapsed judgmental tendencies to perceive organisational goals to be targeted during the implementation

2.2 Inferential figures and tables



Note, the graphs have been drawn using 'jittering' so that these (ordinal) data points do not lie on top of each other.

Figure 5: Jittered scatterplot depicting respondents' judgments related to the variables success, satisfaction, and benefit in three separate two-dimensional plots



Note: the size of the circles represents the amount of respondents with the same opinions.

Figure 6: Scatterplots of the relationship between perceived success and the perceived goal-fulfillment scale, and each particular targeted implementation goal (patient-safety, patient-centeredness, efficiency) with perceived success

2.3 Complimentary inferential analyses: multivariate statistics

2.3.1 Predicting overall success by respondents' perception of importance of multiple implementation factors

A simple linear regression with survey respondent's ratings to the question of a perceived overall success of the Clinical Portal and CaTHI implementation at GJNH as a dependent variable was performed. As predictors served the answers to the questions of how essential the clinician's involvement, the eHealth team leadership efforts and its clinical background, the organisation-wide effort or the role of the change champions, as well as the perceived influence of the national policy was.

Since the distribution of the dependent variable was non-normally distributed, Shapiro-Wilk (55) = .78, $p < .001$, a power transformation following the Box-Cox optimisation procedure was applied to improve parameter estimates of the regression model (Osborne, 2010). The right-skewness was reduced from -1.134 to -.008 by a power factor of 1.95. Plotting the standardised residuals against the standardised predicted values of overall success perception suggests a linear relationship between the variables. Statistically examining heteroscedasticity on this plotted relationship confirms the necessary regression model assumption of homoscedasticity, Koenker-test (55) = 1.07, $p = .98$. Autocorrelation testing, according to Durbin-Watson = 1.98, suggests the errors are not auto-correlated (DL = 1.33, DU = 1.81 for $n = 55$ and $k = 6$; cf. Savin and White (1977)). After checking the appropriateness of the regression model's assumptions and correcting violations, the results of predicting overall perceived success of eHealth and and CaTHI implementation at GJNH yield surprisingly no significant effect of any of the six predictor variables on the dependent variable (see Table 5), all $ps > .11$].

Table 5: Linear regression model predicting overall eHealth implementation success perception from various implementation factors (Q4, Q5, Q8, Q10, Q11, Q12) according to Hypotheses Set 1

	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.79	4.29		0.89	0.41
Q4:	0.85	0.60	0.69	1.41	0.21
Q5:	0.18	0.74	0.16	0.24	0.82
Q8:	0.10	0.49	0.11	0.21	0.84
Q10:	-0.32	1.48	-0.16	-0.21	0.84
Q11:	-0.54	0.68	-0.52	-0.79	0.46
Q12:	-0.50	0.50	-0.37	-1.01	0.35

Note: Dependent Variable: Q1

Assuming a medium effect size of .15 for the predictors and a desired statistical power level of 0.8 as well as an Alpha-level of 0.5, regressing six predictors would require a sample size of 97 respondents. Since the current sample size is 58, the statistical detection power may be too low. However, keeping the assumption of a medium effect size and a 0.8 power level with only one predictor explaining overall implementation success, a sample size of 54 would be required, which is sufficient for the current one of $n = 58$ (Soper, 2014). Rerunning the analyses in six separate regression models predicting implementation success with only one above mentioned independent variable separately at once produces similar null-results as in the whole regression model with all six predictors included at the same time, all $ps > .20$. Taken together, these results refute Hypotheses Set H1.1 to H1.6 assuming a medium sized effect. Yet, a word of caution, in case of small effects size, the null-effect may be a false negative and due to a lack in statistical detection power rather than a true rejection of the stated null-hypotheses.

2.3.2 Predicting overall success by respondents' perception of eHealth benefits independent of system satisfaction

Regressing the degree to which someone perceives system benefits onto a satisfaction level does forecast how contented someone is overall with the eHealth system, rejecting H3.1, $b = .33$, $t(54) = 3.54$, $p < .01$, $\eta^2 = .43$, $F(1, 53) = 11.93$, $R^2_{adjusted} = .17$.

Hypotheses 3.2 and 3.3 were also additionally examined by linear regression: overall Clinical Portal and CaTHI implementation success served as dependent variable to be

explained by the independent variable's overall system satisfaction and overall benefits, $F(2,52) = 6.29$, $p < .01$, $R^2_{adjusted} = .17$. The results point towards a divergence in the predictive power of the independent variables. Yet, the findings are not in line with H3.2 and H3.3.

Table 6: Linear regression of implementation success (DV) predicted by system benefits and system satisfaction

	Unstandardised B	Std. Error	Standardised Beta	t	Sig.
Constant	-3.96	6.21		0.64	0.53
System benefits	-0.43	1.20	-0.05	0.36	0.72
System Satisfaction	5.16	1.54	0.46	3.34	0.00

Note: dependent variable is overall perception of implementation success

2.3.3 Predicting overall success by respondents' perception of system benefits mediated by strategic goal fulfillment

To test these hypotheses multivariates, first a variable labelled goal fulfilment was created as the mean score of the ratings related to the targeted organisation goal: patient safety, patient centred service, and efficiency. To test the proposed mediational model, in step one, a regression was calculated explaining the degree of overall perceived strategic goal fulfilment by overall perceived benefits in day-to-day life, $F(1,38) = 11.87$, $R^2_{adjusted} = .22$, Table 7. In step two, goal fulfilment serves as an independent variable to predict overall implementation success perception $F(1,38) = 4.33$, $R^2_{adjusted} = .08$, Table 8. In step 3, overall success is explained by goal fulfilment and perceived system benefits, $F(2,37) = 2.14$, $R^2_{adjusted} = .06$, Table 9. However, since this does not yield any significant effect necessary for a mediational model anymore, the Hypotheses Set 4 can already be rejected.

Table 7: Linear regression of the strategic goal fulfillment scale (DV) by system benefits

	Unstandardised B	Std. Error	Standardised Beta	t	Sig.	Zero-order correlation
Constant	2.18	0.50		4.39	0.00	
System benefits	0.40	0.12	0.49	3.45	0.001	0.49

Table 8: Linear regression of implementation success by goal-fulfillment scale

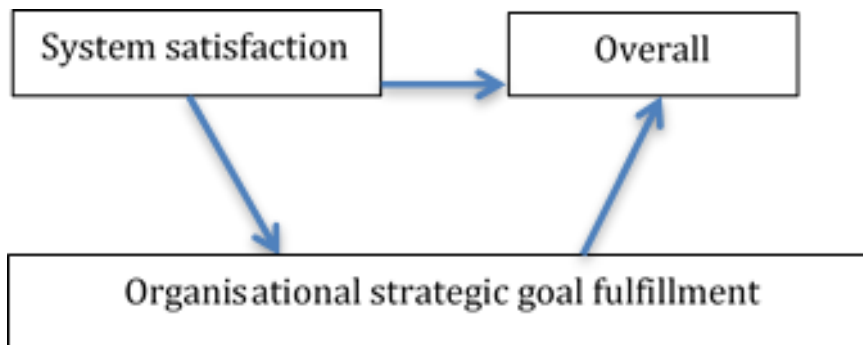
	Unstandardised B	Std. Error	Standardised Beta	t	Sig.	Zero-order correlation
Constant	3.48	5.76		0.60	0.55	
Goal fulfilment	3.04	1.46	0.32	2.08	0.04	0.32

Table 9: Linear regression of implementation success by system benefits and by goal-fulfillment scale

	Unstandardised B	Std. Error	Standardised Beta	t	Sig.	Zero-order correlation
Constant	2.87	6.37		0.45	0.66	
Benefits	0.33	1.38	0.04	0.24	0.81	0.19
Goal fulfillment	2.84	1.69	0.30	1.68	0.10	0.32

2.3.4 Exploratory analyses

Given the pattern of results above, it is reasonable to assume that goal fulfilment mediated by system satisfaction predicts overall implementation success (see the graphic below for illustration). This notion is explored using the mediational model approach as described before. Step one has already established the necessary effect of strategic goal fulfilment on overall success perception (see Table 8). In step two, goal fulfilment predicts system satisfaction (Table 7), $b = .44$, $t(53) = 2.89$, $p < .01$. In step three, the relationship



established under step one disappears when entering satisfaction as an independent variable into the same model with goal fulfilment predicting success as a dependent variable (Table 10, $F(2, 37) = 6.15$, $R^2_{adjusted} = .21$). A Sobel-test confirms the full mediational model, $Z = 2.24$, $p < .05$.²

Table 10: Linear regression of implementation success by goal-fulfillment scale and satisfaction

	Unstandardised B	Std. Error	Standardised Beta	t	Sig.	Zero-order correlations
(Constant)	-6.57	6.51		-1.01	0.32	
Goal fulfillment	1.33	1.49	0.14	0.89	0.38	0.32
Satisfaction	4.15	1.54	0.42	2.69	0.01	0.48

² Since the analyses are conducted, it is necessary to mention the lack of temporal order when examining the data. As such, the applied regression technique to test the mediational model cannot establish causality; therefore, although theoretical assumed, it is possible statistically that the mediational relationship looks different, e.g. not satisfaction is the moderator but goal fulfilment.

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