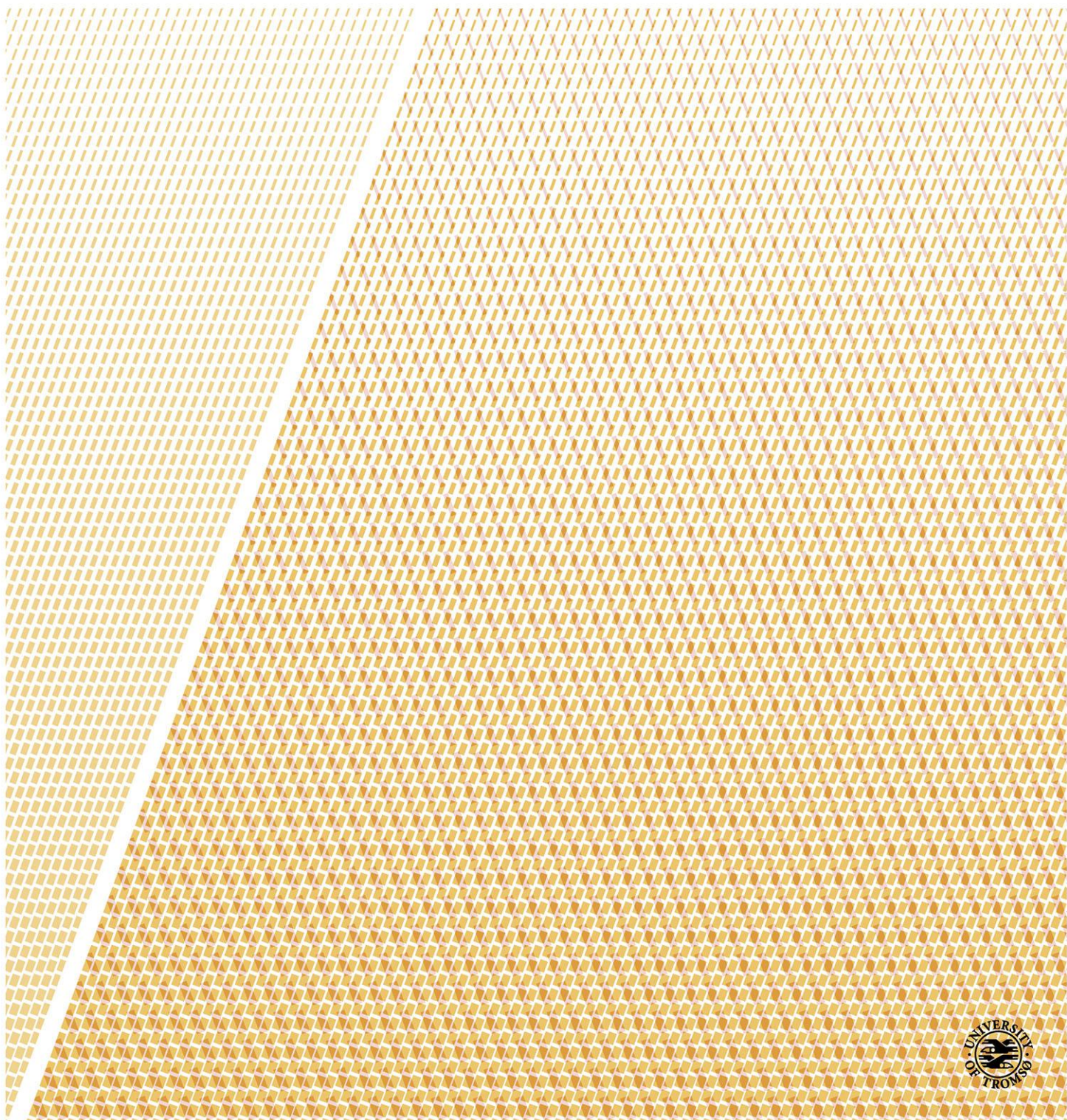Faculty or department

Designing national electronic services in the public healthcare sector

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Eli Larsen
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Abstract

This thesis deals with a socio-technical approach towards the development of inter-organisational ICT tools in healthcare. My overall case is Norwegian healthcare, and I investigated how national inter-organisational ICT tools were developed and why good results were difficult to achieve. Three public projects make up the basis of my data collection in which the main categories of data are interviews, participant observations and document studies. The data collection period spanned 2005 to the completion of this thesis.

The main contribution of this thesis is the empirical insight into the long-standing establishment of inter-organisational health care services in Norway, a country that is characterised primarily by a publicly funded healthcare system. Studying this domain have demanded an inter-disciplinary approach because of the need to understand work practices, the implications of development and the complexities of information infrastructures, financing, project management, political governance and political philosophies.

This study demonstrates how the strategies adopted by Norwegian authorities have changed. These strategies began as measures for invigorating the sector through the funding of public projects that establish specifications which vendors can use in developing new services. The strategies have transitioned into a top-down approach, with the Directorate of Health as the dominant stakeholder in a dedicated and specialised market. The recent strategy represents an approach that prioritises projects in a political process instead of basing such projects in extensive discussions in the healthcare sector.

On the basis of the results, I suggest that a middle position be adopted in organising large-scale projects on integrated information systems. Such a strategy will give more power to the users of the information system. I believe that in real-world settings, a step-by-step strategy is favourable but requires good conditions for continued growth. Critical tasks are to break down large projects into a series of smaller ones, prioritise direct business value and assemble stable, full-time and cross-functional teams that execute these projects along a disciplined agile and optimisation approach.

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1   Motivation

'Who is responsible for the scandal'? The question from the chairman of the Parliamentary Scrutiny and Constitutional Committee was simple and accurate. The answers, however, were ambiguous and inadequate. The statement describes an actual event in Norway in 2011. The Ministry of Health and Care Services and the managers of the largest hospital unit in Norway were summoned and held accountable for unacceptable conditions at a public hospital. A key point in the deliberation was the significant investment infused into an information and communication system that was intended to enable seamless electronic communication amongst several health care institutions.

This backdrop forms the basis of my thesis, that is, the issues concerning the establishment of services for electronic co-operation amongst health care institutions. Ill-thought-out investments in information and communication technology (ICT) systems rarely warrant interrogation in parliament, but a well-documented fact is that electronic co-operation amongst the health institutions in Norway is not as seamless as authorities expect (Rambøll 2004; NMH 2008; Riksrevisjonen 2008; Riksrevisjonen 2014). For years, Norwegian authorities have endeavoured to encourage the health sector to establish inter-organisational communication. As early as 1990, a centre mandated to formulate national standards for secure electronic collaboration was established, and in 2004, a secure health information infrastructure operated across all of Norway. Norwegian authorities have also issued a grant for the development of new electronic co-operational services. These initiatives have been carried out in accordance with national strategies that were first formulated in 1997 and regularly revised thereafter. In recent years, the authorities have also established a significant project organisation at the Directorate of Health to accelerate the process and advance the creation of sustainable services. Nevertheless, these early efforts are regarded as insufficient, or as one member of the Directorate expressed, *'Norway is the land of thousands pilots! Communication solutions are tested but are not put into normal operation'*.

The lack of seamless communication may have serious consequences. A potential problem is the management of medication information, which is included in the electronic patient records (EPRs) of general practitioners (GPs), hospitals and home care providers. In Norway and in most countries, this information must be copied and pasted into letters for transmission to different health care providers. This inefficient practice may cause adverse drug events

(Nebeker et al. 2004) because physicians may prescribe new medication without being aware of existing medicine regimes. A study from a hospital in Norway reveals that 20% of hospitalisations involving elderly people were caused by adverse drug events (Buajordet et al. 2001).

Even though patient information is stored in a sophisticated information system in each health care institution, such information is manually disseminated during co-operative efforts, thereby increasing workload and the risk of committing mistakes. This inefficient and awkward manner of co-operation increases costs and decreases patient security. Norwegian authorities pay more than 80% (OECD 2011) of total health expenditures; similar to other public health care providers, therefore, these authorities are intent on operating an effective healthcare system that provides optimal patient security (Hartley 2005).

This thesis presents case descriptions that illustrate the processes that were implemented in the initiative to establish such services; some succeeded, others did not and the rest are ongoing. The case studies, together with research on how Norwegian authorities influence the endeavours of the health sector, form the basis of the analysis. The thesis focuses on the users of the information systems, the vendors of such systems and the authorities and discusses the perspectives of these three main actors. In this manner, I demonstrate why electronic co-operation services are extremely difficult to develop and adopt as regular services. Another one of my aims is to define appropriate strategies that Norwegian authorities can employ to achieve co-operational electronic services in the healthcare industry. Even though this thesis focuses on a specific sector in a small country, I believe that the results are generalisable to other countries and sectors.

1.1 Theoretical perspective

Scientific work always involves at least two interacting fundamental components: the empirical questions/problems under investigation and the theoretical framework. A theory is a simplification of the real world and is an instrument for understanding the world in a way that would have been difficult to understand otherwise. Theories are nothing else than ideas about how to analyse specific situations. They do not provide answers or final explanations, but they give rise to ideas about how situations or phenomena are correlated (Enderud 1984). The real world that I have investigated is the Norwegian healthcare domain, where inter-organisational ICT tools have been planned, developed and/or implemented. This domain is

characterised by numerous human actors, organisations, technologies, regulations, policies and financial constraints. Understanding this domain necessitates the use of a number of theories and explanatory models that reveal the mechanisms that play an important role in the domain.

Studies on information systems have demonstrated the interconnected and inseparable relationship between technology and the people who use the systems. In the healthcare sector, this relationship has been demonstrated in research on the introduction of EPRs (Berg 2001; Ellingsen 2002). A common determination in these studies emphasises the need for a socio-technical approach, which is a theoretical approach that considers both sociological and technical aspects. The term 'socio-technical' in these contexts describes an approach to complex organisational studies that recognise the interaction between people and technology in workplaces. This philosophy underlies the basic strategies for the manner by which I examined the current theme. Despite this basis, my study's focus extends beyond the use of information systems in individual workplaces. In this regard, I used information infrastructure theory to understand the characteristics of information systems that are interconnected in large networks and to analyse how these characteristics contribute to the obstacles that emerge when inter-organisational practices are introduced.

The healthcare industry is a sector of public concern in many countries, including Norway. The way that this sector is organised and funded is therefore a political matter. To elucidate the strategies that Norwegian authorities adopt in handling ICT issues in relation to healthcare, I highlighted political philosophies that appear to match those that are prevalent in Norway. In the description of new public management, I determined the principle that governs the manner by which the Norwegian healthcare sector is organised and funded. Under neo-liberalism, regulatory authorities do not intervene in the relationship between vendors and users of (for example) information systems in healthcare. The politics inspired by neo-liberalism also results in trade regulations that influence how public organisations act when it comes to procuring (for instance) information systems.

1.2 Research setting

To describe the target of this study, I referred to three projects that were implemented in from about 2005: the ELIN-k, ePrescription and Core Health Record projects. The Core Health Record is represented in three different initiatives, for which the core objective was to

establish electronic co-operational functionality. The characteristics of these projects make them suitable subjects in research on an extensive domain. In the data input period, no other projects where considered to be of such national scale.

The ePrescription project was intended to create a service that replaces paper prescriptions with electronic prescriptions and was expected to present advantages to all involved actors. Under this system, a patient can have his/her prescription safely distributed to any pharmacy, and GPs can monitor the medication that other doctors had prescribed to the patient. The project was initiated in 2005, and after a failed pilot test in 2008 and major modifications, the electronic prescription system was deemed ready for a new pilot test in 2010. This time, sufficient results were derived and the service was rolled out throughout Norway in 2013.

The goal of ELIN-k was to develop a set of standardised messages that enable the home care sector to communicate with GPs and hospitals. ELIN-k was the first project that used standardised electronic messages in the municipal healthcare sector. The messages revolve around logistics, applications, medication and diverse information. The project was scheduled for completion in February 2008, but problems impeded progress and substantially delayed implementation. In 2013, communication via this system began to gradually gain prevalence. The essence of the projects that were designed to establish the Core Health Record lies in the creation of services that enable health care personnel to read patient summaries from a shared database. The idea is that essential information is available regardless of which division of the healthcare system a patient avails services from. The establishment of the Core Health Record has been a laborious process that was first carried out by the Trondheim municipality. The involved parties experienced difficulties in making progress, and the project was terminated in 2009 without having delivered any kind of service. In 2011, the government approved and financed a project that was designed to create another Core Health Record service to be operated by the Directorate of Health. As the authorities started to develop the Core Health Record, the hospital sector represented by its strategic group for ICT, also started a partly overlapping and competing initiative called the Central Medication Service.

1.3 Research questions

A country that finances and operates almost all healthcare-related endeavours is expected to successfully innovate co-operation in the healthcare sector. In Norway, the opposite has occurred; that is, the healthcare sector has lagged behind other domains, such as the banking industry. Thus, the initial questions that arose from my preliminary study were as follows:

Why is creating co-operational electronic services in Norwegian healthcare extremely difficult, and how can alternatives be implemented to achieve success? These questions were refined and sub-divided into manageable research questions.

Given that Norwegian authorities have introduced an increasing number of national health projects, I deemed identifying the characteristics of these projects necessary. Such identification forms the basis of the first research question: What is the nature of government-initiated inter-organisational integration projects for healthcare?

The authorities are in charge of numerous control options, such as adopting organisational changes, creating funding opportunities and formulating regulations that in some way become the principles for governing the sector. Nevertheless, because of (for instance) international regulations, Norwegian authorities are constrained in their operations. All kinds of intervention practised by regulatory authorities engender significant results. Studying the 'toolbox' used by the authorities and the consequences of using it constitutes the essence of the d research question: How do Norwegian authorities influence the development of information systems, and what are the consequences of such influence?

Information systems for healthcare are developed and sold by private vendors, with health care institutions as the customers or end-users (Greenhalgh et al. 2009; Johannessen and Ellingsen 2009; Halford et al. 2010). A crucial requirement, therefore, is to establish close co-operation between these two groups to create a co-operational service that provides added value to both parties. This issue is the focus of the third research question: How can projects on inter-organisational information systems be organised and operated to ensure progress, deployment and sustainable use?

Public healthcare is benefitted when technologies enable safe and convenient co-operation amongst health care institutions. A challenging task is developing suggestions that advance innovation in the use of ICT in healthcare. This is the intention that underlies the fourth research question: What useful strategies can Norwegian authorities employ in operating national ICT projects for healthcare?

On the basis of these questions, I developed an overall research question: How can large-scale national development processes be organised to ensure well-working information systems?

Research question	Article 1	Article 2	Article 3	Article 4	Article 5
What is the nature of government-initiated inter-organisational integration projects for healthcare?	■	■	■	■	■
How do Norwegian authorities influence the development of information systems, and what are the consequences of such influence?	■	■	■	■	■
How can projects on inter-organisational information systems be organised and operated to ensure progress, deployment and sustainable use?		■	■	■	■
What useful strategies can Norwegian authorities employ in operating national ICT projects for healthcare?		■	■	■	■

Table 1: Papers and research questions

1.4 Results and contribution

The main contribution of this thesis is the empirical insight into the long-standing establishment of inter-organisational health care services in Norway, a country that is characterised primarily by a publicly funded healthcare system.

The study shows that a number of factors contribute to the difficulties that health care users encounter in serving as influential and engaged customers when availing of inter-organisational ICT services. From a vendor's perspective, they experience challenges because of inadequate satisfaction of requirements and the lack of willingness to pay for new services.

This study also demonstrates how the strategies adopted by Norwegian authorities have changed. These strategies began as measures for invigorating the sector through the funding of public projects that establish specifications which vendors can use in developing new services. The strategies have transitioned into a top-down approach, with the Directorate of Health as the dominant stakeholder in a dedicated and specialised market. The recent strategy necessitates earmarking funds out of the state budget. This approach prioritises new inter-organisational ICT services in healthcare in a political process instead of the initiatives being extensively explored only in the healthcare sector.

1.5 Structure of the thesis

The rest of the thesis is organised as follows. Chapter 2 presents a review of the large-scale projects in Norway. Chapter 3 outlines the theories and concepts used to understand wide-ranging healthcare-related issues, from political problems to those revolving around the situation of information system users. Chapter 4 discusses the methodical approach and study design. Chapter 5 explains how Norwegian healthcare is organised and how the ICT evolution has taken place in the sector. This chapter also more comprehensively discusses the projects investigated in the case study. Chapter 6 presents the articles that I have written on Norwegian healthcare information systems. Chapter 7 elaborates on the implications of the study and presents the concluding remarks.

2   Norwegian healthcare – organisation and ICT evolution

This chapter briefly explains how the healthcare sector in Norway is organised and describes the strategic actions that the authorities have taken to improve inter-organisational co-operation in the healthcare sector.

2.1   Healthcare structure and strategies in the 1990s–2014

Norway, a country with about five million citizens, spent 9.2% of its GDP on healthcare in 2011 (OECD 2011). That same year, the public expenditure on health reached 86% (OECD 2011). These figures indicate that Norway allocates significant public spending on healthcare.

The main actors in clinical healthcare in Norway are hospitals, GPs, home care providers and nursing homes. This structure has been stable for several decades. Although the sector is primarily public, it is characterised by various ownership structures and funding schemes. GPs run private offices with strict regulations concerning refunds from national authorities. About 4,000 GPs operate in Norway, and all Norwegian citizens are entitled to a dedicated GP. A GP's income is based on the number of patients to whom he/she provides services and the number of consultations that the GP holds.

Home care providers and nursing homes are run and funded by the local authorities. The 429 municipalities in Norway are autonomous in that they are given latitude in terms of using their tax income freely, as long as they meet the minimum requirements that the government sets.

In 2002, a hospital reform turned over responsibility for Norwegian hospitals from counties to four regional health authorities, thereby centralising ownership to the Ministry of Health and Social Care. The reform focused on improving hospital efficiency by introducing a business model and framework, which serve primarily as a means of political control. The reform also set up new management principles for the hospitals on the basis of a decentralised enterprise model.

The overall responsibility for government policy on health care services in Norway lies with the Ministry of Health and Care Services; the Norwegian Directorate of Health is an executive agency and competent authority that is subordinate to the Ministry. The political frameworks within which the Directorate is mandated to operate are the political platforms of the government in office at any time, as well as government and parliamentary resolutions.

The political values conveyed in the annual national budget and the instructions in the annual letter of allocation from the Ministry of Health and Care Services are determinative.

Electronic communication amongst the health care institutions in Norway began as early as the 1980s when GPs began communicating with laboratories. Given the growing interest in electronic communication, in 1990 Norwegian authorities established a centre (KITH) that was assigned to formulate national standards for secure electronic collaboration in the healthcare sector. The first national action plan for ICT in the sector was implemented in 1996 (NMH 1996). The plan, 'More health for every BiT: 1997–2000', was partly a response to the need to exploit the potential of information technology. The year 1997 was, in many ways, the commencement of more comprehensive planning and coordination of the healthcare sector's ICT infrastructure in Norway. 'Seamless electronic co-operation' is emphasised in all the strategy documents that the Ministry of Health and Social Care has published since 1996 (NMH 1996; NMH 2001; NDH 2006; NMH 2008; NMH 2009; NMH 2012). For example, when the government enacted the co-operation reform in the healthcare sector in 2009, it stated that all documentation and information exchange shall be electronically. All related regulations states deadlines within a few hours within which communication between a hospital and the municipality must be concluded—a requirement that is impossible to achieve without electronic communication.

In the hospital sector, the Ministry of Health and Social Care implemented tangible strategic measures based on the hospital reform in 2002. The Ministry sent a management document to the four regional health authorities, mandating them to establish a joint strategic group for ICT-based communication between the Ministry and regional health authorities. The basic idea was to build a hospital sector with systems that can collaboratively operate as an integrated community because such integration is deemed conducive to improved efficiency. The strategic group for the hospital sector became an established unit called the National ICT, which holds regular management group meetings and is allotted a separate budget and a project office for operating ongoing projects.

The health sector ICT strategies that the authorities have published since 1997 were normally supported by funding from the Directorate of Health to stimulate electronic co-operation in the sector. Public organisations were invited to apply for grants to be used in running projects. The organisations were required to allocate the grants to the public aspects of a project and did not include funding for (for example) private sector expenditures, such as procurement of vendor services. The idea is that a product (applying a function in an existing

application) should be attractive to users and should create income in the form of new sales and increased license income. However, public projects have not been able attract the vendors that they were dependent of, like the EPR vendors. In some national projects, the acquisition of such services were made possible by some funding from Innovation Norway, a public business funding organisation and the Norwegian government's most important instrument for the innovation and development of Norwegian enterprises and industries. Grants from Innovation Norway are, however, highly restricted in scale and come with a stipulation that the use of funds should not create market distortion. The strategy has slightly changed in the past decade because some projects have been approved at the government level as national projects that are established as part of the Directorate's initiatives. These dedicated projects received more substantial grants than that issued by the Directorate of Health.

As in most other healthcare systems in Western countries, that of Norway features the EPR as the key tool for numerous activities, both medical and mercantile. Private companies develop and sell these systems, and in Norway, about 10 vendors dominate the market of supplying the needs of the country's most critical health care institutions, including hospitals, GPs, home care providers and nursing homes. EPRs are specialised in that each institution employs a system that caters specifically to their purposes. Most vendors develop for a specific kind of institution, and Norwegian authorities have not attempted to standardise records, as in the process adopted by the Danish (Jensen and Aanestad 2010).

Since the end of the 1990s, most of the Norwegian GPs have used EPRs. An increasing number of GPs have begun sending referrals to and receiving discharge letters from hospitals, in addition to communicating with laboratories. Since the 1990s, the municipal sector has gradually used EPRs for their patients, primarily for administrative and statistical concerns. The hospital sector started using EPRs in the 1990s, and in 2001, 74% of somatic hospitals acquired a license to use an EPR system (Laerum et al. 2001). Before the 2002 hospital reform, the hospitals employed staff who operated the ICT system, and the internal development of 'home-made' applications was normal practice. These applications are usually unintegrated, thereby resulting in a fragmented information bank for physicians. After 2000, electronic referrals, discharge letters and X-ray photos, amongst others were exchanged at a small scale amongst actors in the Norwegian healthcare sector. The need for communication emerged at all healthcare levels and in certain authorities (for refunds, applications, submission of statistics, etc.). During the last decades, the authorities have

attempted to contribute to the development of national information infrastructural services for Norwegian healthcare. In what follows, I present the public initiatives that have been implemented in recent years.

In 1997, the North Norwegian Health Care Network (NNHN) was established, with the aim of setting up a dedicated ICT network for information exchange amongst healthcare institutions in the northern Norwegian health region. The Directorate of Health and Ministry of Health funded the project and decided that the other four health regions should do the same. In 2003, when the Norwegian Health Care Network was established, the NNHN was merged into this organisation. The Network, which was a success, offered secure connection to health care institutions.

In 2002, the first preparation for the ELIN Project was carried out, with the Norwegian Medical Association as a key player. It was established to contribute to developing user-friendly solutions for electronic health care-related communications for GPs. The project was partly financed by the authorities and has played a major role in the development of user requirements for ICT solutions that support communication between GPs and other healthcare institutions. The communication covers such tasks as exchange of admission and discharge letters, lab orders and reports, illness records and doctors' declarations, prescriptions and patient correspondence. The requirements have been incorporated in implemented solutions, which have been disseminated to a certain extent, although at a pace slower than expected. The ELIN Project planned to develop electronic prescriptions, but this responsibility was deemed excessively complicated and expensive. After the termination of the project, several other ELIN project initiatives have been carried out with new key actors but with financial support from the authorities.

In 2005, the authorities attempted to invigorate the sector by establishing a number of 'Lighthouse Projects'. The factors common to these initiatives are that they were spearheaded by local authorities, and they were intended to establish electronic services for hospitals and the municipal sector. The public component of these projects was financed by the Directorate of Health; expenditure on the vendors that developed the different services was not financed by the Lighthouse funds. These projects failed to deliver the desired results.

The ePrescription project was initiated also around 2005 by the Ministry of Health and Care Services to create a service that replaces paper prescriptions with electronic prescriptions. The most pressing argument was that the authorities need a copy of all refundable

prescriptions that are handled by pharmacies. For this reason, the Office of the Auditor General encouraged the government to spearhead the ePrescription project, and funding was provided for in the state budget. The Directorate of Health took charge of management, thereby making ePrescription the first healthcare project of this magnitude to be managed by a top regulatory body. In November 2012, 90% of all the GP offices in Norway were technically able to send electronic prescriptions, but only 60% actually used the ePrescription service. Some hospitals are expected to avail of the service in 2014.

The next large-scale public project for which the Directorate of Health was responsible was the 2009 Core Health Record. This project was aimed at designing and implementing a new service that enables the storage of critical patient information in a database that health care personnel can access whenever necessary. The Norwegian Parliament approved the investment for the development of the Core Health Record, disbursing a funding that amounted to €50 million. One of the significant justifications for this investment was an economic analysis estimation that presented a calculated savings of up to €100 million from ICT use. In 2013, the service was offered as a pilot in one region.

Both the ePrescription and Core Health Record projects represent a new avenue from which Norwegian authorities can involve themselves in the development of new ICT services for healthcare. The authorities have spent a considerable amount of money during the last 10–15 years in their efforts to invigorate the healthcare ICT sector. Nevertheless, evaluations and status reports indicate that only minor improvements in electronic inter-organisational collaboration have been achieved (Rambøll 2004; Riksrevisjonen 2008; Riksrevisjonen 2014). Many stakeholders and infrastructures are typically involved, and a recurrent characteristic is that the projects tend to be derailed by insurmountable delays, overrun budgets and escalation of ambitions and scope (Ellingsen and Monteiro 2003; Ellingsen and Monteiro 2003; Fleming 2004; Ellingsen and Monteiro 2006; Ellingsen and Røed 2010). A service intended to promote exchange amongst institutions is confronted with additional challenges in the development phase because vendors are needed to advance shared goals (Johannessen and Ellingsen 2009; Ellingsen and Røed 2010). Design is not limited to the development of technology but extends to the development of work practices—a feature that increases the complexity of such an endeavour (Meum and Ellingsen 2011; Johannessen et al. 2012; Pedersen et al. 2012). Onerous procurement processes may also be one of the factors that slow down and present difficulties in large-scale implementations of information projects in the healthcare sector (Johannessen et al. 2013).

The lack of comprehensive progress in the field has been a pressing issue in public evaluations of the healthcare sector. This issue was also emphasised on several occasions in Parliament in 2007. The progress of ICT projects in the healthcare sector arose in one of the debates, whereupon the minister declared, *'I have noticed that several representatives here [in the Parliament] have underlined that there is a need for more national control. I am prepared to exercise it' (Brustad, 29 Mar. 2007).* The minister's words seemed to be a meaningful expression of commitment because the Directorate of Health later became a major agent in the coordination and management of ICT development projects in the healthcare sector. Over the last years, the Directorate has spearheaded projects such as ePrescription and Core Health Record, which represent two of the new strategic measures that the authorities have implemented. The strategy of assigning project management to the Directorate of Health is one of the reasons why Directorate employees working on ICT-related tasks have grown from about a handful in 2001 to about 200 in 2014. Norwegian political parties have supported the chosen strategies, and the issue has not given rise to much controversy.

3 Theory

This chapter first discusses the current status of electronic inter-organisational collaboration at the international level. Second, it discusses the political philosophies that have guided the authorities in their efforts to achieve collaboration, namely, neo-liberalism and new public management. Finally, the chapter introduces information infrastructure theory as the theoretical backbone of the study.

3.1 International status of electronic inter-organisational collaboration

Health care is a substantial component of a Western nation's enterprise (OECD 2011). Public spending on health care accounts for one of the largest government expenditures, representing, on average, 6% of the GDP; public health care spending in OECD regions is projected to increase by 3.5–6 percentage points of the GDP by 2050 (Joumard et al. 2010). Exploiting efficiency gains in health care is therefore a crucial driver of satisfying rapidly growing health care demands without threatening the sustainability of public finances.

A Western healthcare infrastructure is distributed across several institutional boundaries that typically span the practice of GPs, hospitals, nursing homes and home care providers. This feature presents challenges to health care personnel who need a complete picture of patients' conditions to adequately provide services. An example is when a patient is transferred from a hospital to a home care institution; information on medication and care is essential to rendering quality service. A Norwegian study (Von Hofacker et al. 2010) indicates that inadequate communication and co-operation between nursing homes and hospitals are some of the most significant problems encountered in healthcare collaboration. If information concerning a transferred patient is lacking, the health care personnel in charge should exert extra effort to gather sufficient information in order to provide good health services. Such effort, however, entails time, and the information collected may be incorrect and/or inadequate.

The lack of improvements in electronic inter-organisational collaboration in the healthcare sector is also a concern in several other countries (Avison and Young 2007; Ham 2008; Greenhalgh et al. 2009; Greenhalgh et al. 2010; Stroetmann et al. 2011; Riksrevisjonen 2014). In the Netherlands, a number of national projects suffered from pitfalls and problems (Roos 2007). BBC Health News recently reported that a UK health ICT project cost £70 billion (Triggle 2011): *The largest civilian IT project in the world has failed…The*

government has already announced there will be a review of the project' (Triggle, BBC News).

The prevalent trend in many countries today is guaranteeing smooth information flow and effective co-operation amongst different health organisations through influence-building integrated information systems (Danish National Strategy 2007; Swedish Social Department 2010; Department of Health UK 2012; SMH 2012). Two factors that are typically highlighted in this strategy are improved quality of health care and better use of sector resources. These factors share an economic dimension, either directly or indirectly. Given limited resources, regulatory authorities should ensure progress in integration and advance the process in different ways. For instance, in 2004 the US established the Office of the National Coordinator for Health Information Technology (ONC 2014) as the principal federal entity tasked with coordinating nationwide efforts, as well as implementing and using the most advanced technologies for health information and electronic exchange. In 2014, the office disburses $78 million in grants for such purposes. In some instances, a government directly involves itself in running several large-scale projects, as in the National Programme for IT in England (Parliamentary Office of Science and Technology 2004) and the ePrescription and Core Health Record projects in Norway (NDH 2006).

Information systems are key to the development of technological solutions for delivering high-quality, cost-effective and equitable health care (Halford et al. 2010). Interconnection amongst different healthcare information systems has become a natural step towards further advancing anticipated developments. One may regard integration as positive for all parties involved, but the distributed, negotiated and partly unpredictable character of networks (Latour 1987; Latour 1999) indicates that the envisioned effects of integration are not necessarily a given. Several studies have demonstrated how integration delimits action (Boudreau and Robey 2005). McCormick (2012) found that easy electronic access to test results increases the likelihood that doctors will request for imaging and lab tests by as much as 70%. This result raises questions about the presumed cost savings of ICT-oriented healthcare systems. Integration therefore brings about both benefits and costs (Rolland and Monteiro 2002). One actor may deem an integrated system excellent, whereas another may evaluate it as poor; such opinions are all a matter of perspective.

Large-scale public projects have been the focus of Flyvbjerg (2005; 2009) and Wachs (1990), who reveal that the major problems in the planning of large-scale infrastructure projects are the high level of misinformation about the costs and benefits that decision makers receive as

they decide on whether to proceed with building and the high risks that such misinformation generates. Wachs (1990) concludes that forecasts of costs and benefits are presented to the public as bases for deciding on whether a project is to be undertaken, but in reality, these are means of obtaining public funding for a favoured project. The author also indicates that this phenomenon is of 'nearly universal abuse' and that it is not confined to transit planning but common in all economic sectors where forecasting routinely plays an important role in policy debates. Flyvbjerg (2009) reveals that this practice continues to prevail in extensive infrastructure projects, and Wachs (1990) expects this to be a widespread phenomenon in other sectors. For projects that are allotted substantial public funding, regulatory authorities monitor the development process to ensure that the investment generates good returns. The minimal progress in earlier initiatives on developing inter-organisational services has inspired calls for even stronger government control and coordination (NMH 2008; Riksrevisjonen 2008). Such a top-down approach is in accordance with that discussed in the management literature (Davenport 1993). The eagerness to control the development of information systems in the healthcare sector appears to be an extensive phenomenon (Mundy and Chadwick 2004; Salmivalli 2006; NEHTA 2009; Nictiz 2010). The perspective that underlies these inter-organisational development initiatives is the understanding that new electronic systems should benefit society. One of Flyvbjerg's (2005) interview subjects, a professional planner of public projects, explains the perspective as follows:

> *The system encourages people to focus on the benefits, because until now there has not been much focus on the quality of the risk analysis and the robustness [of projects]. It is therefore important for project promoters to demonstrate all the benefits, also because the project promoters know that their project is up against other projects and competing for scared resources.*

The connection amongst economic analyses that present the expectation of benefits, government financing and top-level management is exemplified by the Norwegian Core Health Record project. As previously stated, the government invested €50 million based, amongst other things, the analytical estimation that projected a savings of up to €100 million. The Directorate of Health currently manages the project.

3.2   Political philosophies

The manner by which public healthcare is operated highly depends on the current measures that politicians implement; the choice of measure, in turn, considerably rests upon the

philosophies that these politicians believe will generate excellent results. Understanding the development of so-called 'national services' in a public sector therefore necessitates knowledge of prevalent political philosophies because such principles inform regulatory intervention in public sector initiatives. In this chapter, I shed light on two dominant political philosophies in Western states today (Dean 1999), namely, neo-liberalism and new public management. These two concepts are closely linked but are separately described.

Neo-liberalism is a set of economic policies that have enjoyed far-reaching application during the last 25 years. American economist Milton Friedman is widely known for laying the foundation of neo-liberal thought (Friedman and Friedman 2002). The term 'neo-liberalism' comprises two ideas: 'neo', meaning new and 'liberal', meaning free from government intervention. The market and the individual are at the core of neo-liberal philosophy; by limiting the influence of the state, unregulated market capitalism engenders efficiency, growth and widespread prosperity for all. Neo-liberalism is characterised by the desire to intensify and expand a market by increasing the number, frequency, repeatability and formalisation of transactions. To achieve this outcome, the market should be based on the free flow of services, goods, manpower and capital. Friedman maintains that free markets create the best conditions for democracy; when people have power over their own economic choices, they also require power over those who exercise state authority. The existence of free and autonomous individuals and organisations and a strong private sector with only limited state interference is key to neo-liberal politics. Neo-liberalism justifies the limitation of government intervention in a market by maintaining that markets are complex and unpredictable; these features indicate that in a progressive market, the state cannot be the sole regulatory authority (Gordon 1991).

During the 1990s, many service providers in advanced economies, such as the UK and Scandinavia, were pressured to evolve into efficient and effective organisations to reduce the burden carried by taxpayers whilst maintaining the volume and quality of services supplied to the public (Brignall and Modell 2000). Political action in neo-liberal governments aims to maintain order and security and construct frameworks that shape society. Public properties and services should be operated on the basis of market economic principles. Neo-liberalism recommends that the organisational boundaries between the public and private sectors be modified and that the public sector be as similar to the private sector as possible (Mydske et al. 2007). Reforms based on this argument have been advanced in accordance with the principle of indirect governance. That is, autonomous organisations should determine ways to

adjust their practices in accordance with political expectations. This concept of running public properties and services on the basis of a market economy is called new public management, which is a very broad concept that has been used to describe a series of reforms in the public sector since the 1980s. New public management revolves around increasing efficiency in and control over the public sector. A central hypothesis of this perspective is that increased market orientation in the public sector leads to the cost-effective provision of public goods, without the negative side effects produced by other measurements and assessments. Amongst the measures that have been carried out to ensure excellent consistency between needs and resources in the public sector are outsourcing, privatisation, internal pricing and unit pricing (Ferlie et al. 1996). For instance, a public hospital can receive income in the form of grants on the basis of the number of patients that it treats. Such an incentive will motivate public hospitals to effectively manage themselves and attract patients (or 'customers' in market economic terms).

Numerous other Western countries have participated in the new public management movement during the last decades; this participation has been characterised mainly by a strategy of increased specialisation, delegation, structural devolution and fragmentation (Hood 1991; Christensen and Lægreid 2001; Pollitt and Bouckaert 2004). Public administration is, in itself, the self-expression of a vertical (hierarchical) specialisation: the state is located at the top and several authorities fall at the lower levels. Within each level, increasing professional fragmentation occurs, thereby leading to vertical specialisation (Pollitt and Bouckaert 2004). Fragmentation poses challenges, and the current resolution to this problem increasingly tends towards coordination and integration across levels and sectors (Christensen and Lægreid 2004; Verhoest and Bouckaert 2005). ICT assumes a central position in this process (Bartels et al. 2010). The coordination and co-operation that these ICT systems support include the use of inter-organisational systems, which challenge the development of ICT systems even more strongly than do systems within an organisation (Ellingsen and Monteiro 2006; Aarts et al. 2007; Bossen 2008).

The free flow of services, goods, manpower and capital is usually not absolute. In practice, several countries co-operate and create internal markets where this free flow principle functions. Comprehensive negotiations result in detailed agreements about trade practices within an internal market and between the internal market and the rest of the market. Given that trade agreements exist in the internal market, customers and vendors are compelled to act in accordance with the legislative framework of that market. Regulations and threats of

sanctions position trading bodies as significant actors. The European Economic Area (EEA) (European Union 1994), with its European Free Trade Association (EFTA) Court (EFTA Court 1992), is an example of the former. The agreement constrains the freedom of states to support national industries.

> *The Court is mainly competent to deal with infringement actions brought by the EFTA Surveillance Authority against an EFTA State with regard to the implementation, application or interpretation of an EEA rule, for the settlement of disputes between two or more EFTA States, for appeals concerning decisions taken by the EFTA Surveillance Authority and for giving advisory opinions to courts in EFTA States on the interpretation of EEA rules* (EFTA Court webpage).

For instance, if a public organisation that is an EEA member wants to buy a product, service or software, a national request for tenders must be extended when the investment exceeds €60,000, and a request for tenders must be extended to the entire internal market when the investment exceeds €120,000. Rigid regulations control entire transactions between vendors and customers, covering announcement to contract signing. Thus, the regulation itself becomes an obligatory passage point (Callon 1986). Tender legislation ensures the effective use of public funds through cost-effective purchasing and encourages the development of competitive business. Tendering is the first step in an extensive customer–vendor process that is completed by the delivery of a new service, system or function.

Neo-liberalism and new public management are both politically influenced perspectives. Although Norwegian authorities do not clearly identify these paradigms as part of their governance, several scientific papers indicate how these political philosophies have been practiced in Norway (Christensen et al. 2003; Mydske et al. 2007; Christensen et al. 2008). The healthcare sector has carried out several reforms to create competition in the sector and guarantee that the sector works within frames that are typical of the private sector (Christensen et al. 2003; Christensen et al. 2008).

Norway has also signed international agreements that involve the free flow of goods, services and manpower. For the Norwegian healthcare sector, such agreements indicate that if a public sector agent wants to purchase (for example) an information system worth more than €60,000, the procurement process must adhere to the EEA trading agreement, which implies conformance to international advertising and other specific procedures upon contract signing.

The procurement of items priced between €13,000 and €60,000 is subject to similar regulations, but agreement to advertising requires national disclosure.

A public healthcare sector that is run along the framework of new public management conforms to the same principles that a private company follows. In the healthcare market, patients become 'customers'. Providers of health care services are evaluated in terms of their effectiveness in delivering the services, that is, delivery in such a way that patients are given leeway in vendor selection. To survive, health care institutions need to prove that they can deliver high-quality and efficient healthcare. A focus on procurement with good returns becomes a natural part of a health care institution's concerns. Under neo-liberalism and new public management, politicians are unaware of which investments (e.g. product or service) are the best for health care institutions. This issue is a matter between health care institutions and their vendors because the user of a product/service is the entity that knows how a product/service should be designed. Another issue is that when a publicly owned institution purchases a product/service, it is obligated to act in line with regulations that demand tender processes. In a tender process, institutions are expected to describe in advance the products/services that they intend to purchase.

However, the procurement of inter-organisational co-operation technologies is not a straightforward task, wherein purchasers simply choose amongst off-the-shelf systems. Procurement in this context normally implies tailored system development, a difficult task to handle (Oliver and Ebers 1998; Dekker 2004). Tailoring is frequently characterised by top-down management and therefore mirrors strategies from the management literature (Davenport 1993; Ashkenas et al. 2002). The approach assumes that authorities have the resources and power to operate projects in a structured and controlled manner and that they can effectively coordinate activities amongst different and often autonomous stakeholders. In the purest form of top-down management, all directions come from the top. Project objectives are established by top management, and top managers provide guidelines, information, plans and fund processes. In this approach, the idea is to begin with the big picture, after which specifications are further broken down to detailed descriptions as sub-systems are developed. In system development processes, the top-down approach is typically associated with the waterfall model (Thummadi et al. 2011). The waterfall model is a sequential model of development activities, in which a substantial planning phase is executed at the beginning of the process (including the upfront preparation of requirements) before the development phase

with coding, testing and implementation is initiated. Through this scheme, management builds a complete picture of a project before execution.

The waterfall method is a formal approach that entails considerable effort in documentation, planning and control. It begins with requirements analysis and then proceeds to design, coding, testing and finally, delivery. The perceived benefits of the model are predictability, stability and control of the development process (Lyytinen 1987). The main argument for the model is that time spent early in the process ensuring the correctness of requirements and design saves time and effort later. It also provides a structured and linear approach that is easily understandable, provides milestones that are easily identifiable and ensures a predictable financial situation. The waterfall approach enables health care institutions to describe in advance the products/services that they want to purchase. This approach appears to correspond with the basic idea that placing requirements in an open tender affords institutions the best procurement price. Despite the aforementioned advantages, however, the success of the model is grounded on an assumed stable environment and unchanging requirements throughout the development process; many practitioners also criticise it for being excessively mechanistic and inflexible, as well as dismissive of the ambiguous context of design processes (Qumer 2007; Thummadi et al. 2011). Acknowledging that development is not a sequential process, stakeholders use the waterfall model primarily to present '*an image of control*' (Nandhakumar and Avison 1999). From the standpoint of customers/users, a prominent perspective is as follows: '*Unfortunately, many sponsors and stakeholders demand this early precision and detail because it gives them (false) comfort regarding the progress achieved*' (Royce 2005).

Given the intense criticism against the top-down approach in many information system projects, scholars have advocated for a bottom-up approach (Braa et al. 2007; Hanseth and Lyytinen 2010), in which the central elements during the design of an additional system are users' work practices and existing information systems. These systems are then linked to create larger systems, which are also merged, sometimes at many levels, until a complete top-level system is formed. This focus on existing systems and work practices is essential in design and project organisation that are underlain by a bottom-up perspective. Unlike the bureaucratic work method in a top-down model, decision making regarding system development in a bottom-up model are designated to users. This approach empowers users not only in terms of decision making, but also in terms of project participation (Suchman 2002). Such a strategy takes us considerably close to day-to-day practice amongst end-users,

thereby enabling designers to effectively deal with the peculiarities of real-life settings (ibid.). Developing technology and testing its use encourage close collaboration between users and designers, increase knowledge and understanding of technology and facilitate the exploration of a technology's potential applications (Orlikowski 1995).

The bottom-up approach has a step-wise nature that builds on existing infrastructures, thereby enabling infrastructures to grow in an organic and dynamic manner, as aligned with the work practices of users (Star and Ruhleder 1996). An organic strategy may result in interwoven sub-systems, which are developed in isolation and adapted to local optimisation instead of geared towards meeting an inter-organisational purpose. Nevertheless, health authorities are clearly interested in coordinating and standardising various initiatives. This intention implies that although an organic perspective is useful to a certain extent, it may present limitations depending on the degree to which it conforms to authorities' integration strategies.

Design models that adhere to a bottom-up and step-wise design approach are the agile methods introduced around 2000 (Beck 2000; Beck 2002). These methods acknowledge that future needs are difficult to predict and that users cannot always specify what they need through the requirement specification process. In an agile approach, a developer accords high priority to satisfying users through the early and continuous delivery of valuable software, for which requirement changes are welcome. Agile development methods have been criticised by some practitioners and academics, who claim that the lack of focus on architecture causes sub-optimal design decisions (McBreen 2002; Stephens and Rosenberg 2003; Dybå and Dingsøyr 2008), they also deem the methods unsuitable for large-scale projects (Cohen et al. 2004).

In a step-wise development approach, users and vendors can exhibit strong co-operation during the infancy of technological development. A user may be able to construct unique information that a vendor cannot independently produce (Pollock and Hyysalo Forthcoming 2014-2015). Table 2 summarises some of the features of top-down and bottom-up projects.

	Top-down project with waterfall development strategy	Bottom-up project with step-wise development strategy
User participation	Oral, in meetings as consultants	During practical work in real-world settings with influence on future process
Time for user involvement	In the planning phase and during testing of the complete system	Regularly during the entire project period
User requirement preparation	Before placing an order for the complete system/functionality	During the development process
Co-operation between vendor and customer	Very limited	Close collaboration
Suited for tender processes	Yes	No
Top-level manager co-ordinating work in different organisations	Yes	No

Table 2: Comparison of top-down and bottom-up development projects

Despite these insights, portraying the challenges of ICT governance in black and white terms (top-down versus bottom-up) is simplistic. I therefore delved further into some of the issues that are intrusive to progress in the ICT health sector.

Public healthcare accounts for a substantial proportion of expenditure in Western counties (OECD 2011), and authorities believe that improved ICT engenders more efficient healthcare. Seamless electronic communication has been a highlighted goal for several years in many countries, and considerable effort has been exerted to secure appropriate service development and implementation. A problem, however, is that ICT projects are known to deviate from plans, thereby costing organisations substantial time, effort and money (Davis and Venkatesh 2004; The Standish Group 2013). Current government projects are challenged by increased critical attitudes and anticipation of government failure. Thus, public organisations are driven to prioritise error avoidance (Dean 1999) and guarantee that tax payers' money is not wasted on failed system implementations (Griffin and Dempsey 2009). Several national health care authorities have recently assumed a management role to ensure progress in the sector (Hyppönen et al. 2005; SMH 2012; Greenhalgh et al. 2013).

Running a project that involves participation from private and public actors is a complex task (Ciborra 1996; Oliver and Ebers 1998; Dekker 2004). Each actor is independent, and

regulatory bodies have minimal instructional authority even over a public actor. Given this autonomy, an imperative is to acquire acknowledgement of the values of an initiative and sufficient commitment from the actors who will be directly influenced by a new system (Aanestad and Jensen 2011). Satisfying this requirement ensures that a new service is developed in a way that creates good working conditions for all users. To this end, project management focuses on involving all actors in a way that satisfies users. A dilemma that arises from this situation is that the actors who negotiate on inter-organisational ICT design bring significant issues to the table, such as their respective existing information systems, organisational structures and daily routines. In healthcare, these information systems are not stand-alone systems but complex schemes that constitute an information infrastructure (Star and Ruhleder 1996; Hanseth and Lyytinen 2008). From a medical perspective, a health care provider needs relevant information on patients and is obligated to document findings, interventions and planned procedures (Strauss et al. 1985; Timmermans and Berg 1997). Medical documentations are collected in a patient record. Similarly, a patient administration record contains information that is fundamental for logistics, billing and statistics, which in turn play a critical role in planning, financial management and control. The potential for ICT to integrate all this information into a single record is highly attractive to policy makers because it promises to improve quality, cut costs and provide a technological solution to the structural crises (i.e. exponentially rising demand and the need to control public expenditure) that confront most public sector health systems (Halford et al. 2010). A merged information system, called the EPR, has assumed a unique place in healthcare. Even a small-scale medical practice can have a complex information infrastructure, such as EPRs integrated with telecommunications and electronic laboratory requisition systems (Johannessen and Ellingsen 2008).

Because patient information is the key element in an inter-organisational service, EPR vendors have become significant stakeholders in the development of new services. Health care institutions have different EPR systems; thus, several vendors are needed to deliver a functionality that enables the creation of a new service. These vendors are often competitors.

The authority that is responsible for the development of an inter-organisational system in a national project will attempt to recruit and control other actors in such a way that caters to these actors' explicitly stated interests. These interests, as Latour (1986) explains, are *'what lie between actors and their goals, thus creating a tension that will make actors select only what, in their own eyes, helps them reach these goals amongst many possibilities'*. By co-

operating and declaring common goals, inter-organisational actors can move in the same direction as they create a new system. However, each of the actors will have a sub-set of goals that do not necessarily correspond with those of the other actors. This sub-set of goals determines behaviour in future co-operation. Latour (1986) argues that the mere 'possession' of power by an actor does not automatically confer the ability to cause change, which is possible only when other actors can be persuaded to perform the actions necessary for such change to occur. A 'weak' actor will withdraw from a co-operative endeavour if its interests are unaddressed, thereby weakening the remaining group. A parallel can be drawn between this process and city planning. As Davidoff (1965) discusses,

> *[i]f the planning process is to encourage democratic urban government then it must operate so as to include rather than exclude citizens from participating in the process. 'Inclusion' means not only permitting the citizen to be heard. It also means that he be able to become well informed about the underlying reasons for planning proposals, and be able to respond to them in the technical language of professional planners.*

Davidoff argues that different groups in a society have different interests, which would result in fundamentally different plans once the groups are recognised. He believes that in this pluralism, the 'weak' and the 'strong' are influential and that the plan that emerges from such a process is more effective than that prepared only by a planning department staff. Davidoff and Latour emphasise the same point but from two different perspectives.

To summarise, authorities that attempt to manage the design of inter-organisational services face comprehensive challenges for a number of reasons. First, co-operation is created amongst different institutions without an overarching management approach, thereby driving the institutions to establish a common business culture. Second, multiple objectives are formulated and often contested, and outcomes are unstable and equally subject to debate (Kushner 2002). Third, costs and benefits may be unevenly distributed amongst participants (Berg and Goorman 1999), and those who do not receive benefits withdraw from co-operative endeavours. Fourth, a project group is heterogeneous mixture of competing vendors and different customers. If a customer/user is a public actor and the design process is based on the waterfall model, additional challenges will arise. Fifth, delineating the characteristics of ICT services in advance is difficult to accomplish. This delineation so highly depends on the details of users' work practices that it is difficult to express (Greenhalgh et al. 2010). Sixth, the mandatory tender process causes an artificial gap between vendors and customers, meaning that the two groups cannot co-operate.

User participation in a large-scale project that involves several institutions necessitates that the planning and requirement phase be carried out with representatives from the different institutions involved. This approach retains the basic ideal of neo-liberalism, that is, that users should define their own work tools. Although these ideals adhere to bottom-up approaches, participation in practice is constrained by type of co-operation because users (or the representatives of users) carry requirements that are based only on a verbal description of their work situation. Nicolini (2006) argues that this kind of input from users is insufficient. He identifies other elements that are determined by, for instance, observation. These elements include what is said and done, the tempo of practice, the process of material mediation and the interactional sequence of practice. All this information is essential to the development of a new service. Participants may miss important information because people cannot definitively explain every task that they perform and the manner by which these tasks are accomplished. The requirements prepared in this manner during round table negotiations therefore fail to generate concrete results. '*Requirements—probably the most misused word in our industry— rarely describe anything that is truly required. Nearly everything is negotiable'* (Royce 2005).

All these issues suggest that developers operate under circumstances of incomplete understanding of users. User requirements cannot simply be 'read off' by an engineer; instead, these evolve in response to changing expectations of technology, technological conveniences and user practices and concerns (Mackay et al. 2000). Discrepancies between vendors' interpretations of user requirements and actual user requirements are major contributors to software failures (Davis and Venkatesh 2004). Studies have explained the complex interplay between vendors and users in technology development and use, as well as their evolution over time; this interplay is subject to various trade-offs and tensions between (for example) competition and collaboration and between localisation and standardisation.(Johnson et al. 2013). Johannessen et al. (2013) reveal that over time, vendors have established a complex set of arrangements (i.e. knowledge infrastructures) for understanding and managing their relationships with user communities. This challenge, which confronts user participation and requirement specification in top-down projects, gives rise to the need to scrutinise users and their work practices. Given the complexity of an existing system in a health care organisation, the information infrastructure concept may shed light on the problems encountered in designing inter-organisational health care services.

3.3   Information infrastructure

Converting the practices stated in telephone messages or letters sent by post into electronic services necessitates attention to the fundamentally composite nature of these practices. Electronic services must accord with people's requirements, processes, procedures, tools, facilities and technology that exist in involved institutions. They must support the creation, use, transport, storage and wiping of data. As described in the previous section, creating inter-organisational electronic services presents numerous challenges, regardless of the manner by which it is handled. Service users and other stakeholders should agree on how a service is embedded into an existing one to fulfil the needs of all system users. The number of users and other stakeholders are tremendous; thus, the conditions and nature of participation highly depend on the manner through which projects are organised and on selected development models. Software development is the most intensive activity during the creation of a new service, and health care institutions normally have existing information systems. These issues drive the necessity to focus on the nature of interconnected systems. The concept of information infrastructure represents the basic characteristics of a domain where people create, use, transport, store and wipe data via electronic services. Such interconnected systems are defined as information infrastructures (Pironti 2006). Pironti's definition of information infrastructure suggests that everything and everyone who are directly or indirectly involved in an electronic information service are part of an information infrastructure.

Modern professional and scientific practices, including healthcare practices, are always characterised by artefacts, architectures, paper, machines and information systems; these components constitute an information infrastructure (Ellingsen and Monteiro 2003; Mykkänen and Korpela 2003). The work procedures that fall under specific practices are fine-tuned to ensure correspondence with work aids. The accumulated procedures make up a significant installed base. The more extensive a particular practice is, the more infiltrated and complex are the connections amongst all heterogeneous elements.

To approach this overwhelming theme in an analytical manner, Hanseth (2002) characterised information infrastructures by a set of keywords. In what follows, I focus on the characteristics of information infrastructures and how these affect the development of new inter-organisational electronic services. I represented each keyword in the healthcare setting as follows:

- *Shared: An information infrastructure is shared by community members, including vendors, users and staff. Net providers, health care personnel and ICT supporters are examples of such members.*

- *Evolving: An information infrastructure is not 'designed', but continually evolves because of growth and innovation. In healthcare, such evolution is demonstrated by how services and equipment are progressively incorporated into an existing structure.*

- *Open: In principle, the number of users that can be accommodated by an information infrastructure is unlimited. Within healthcare, certain limitations are imposed to protect patient information, but health care personnel can readily access structural components that are relevant to their responsibilities.*

- *Standardised: Infrastructures are grounded on standards that allow for scaling and interoperability. The healthcare sector adheres to a number of standards, including protocols for electronic communication between instruments and treatment protocols.*

- *Heterogeneous: Infrastructures consist of different elements—technology, users, organisations—in large networks. This heterogeneity is extraordinary in a comprehensive field, such as healthcare.*

- *Installed base: Infrastructures are seldom created from scratch; rather, they evolve from existing practices. Healthcare is a long-established institution and has therefore created an installed base, which exists in each health care unit and within clusters of a health care unit (In this context, 'unit' can refer to an organisation, department, office or similar institutions.).*

Information infrastructures occupy a unique position as they become a part of an organisation:

> *Information infrastructures can, as formative contexts, shape not only the work routines, but also the ways people look at practices, consider them 'natural' and give them their overarching character of necessity. Infrastructure becomes an essential factor shaping the taken-for-grantedness of organizational practices (Ciborra and Hanseth 1998).*

An important perspective that information infrastructure theory contributes is the idea that establishing electronic communication amongst health care institutions translates to interconnection amongst different information infrastructures. Hence, a socio-technical approach that considers the nature of such structures is necessary when new inter-

organisational services are developed. Changing an element in information structures, such as shifting from telephone or letters sent by post to electronic communication, influences other surrounding elements. Such a change process transforms the orientation of developmental perspectives from an organisational to a network direction and from a systemic to an infrastructural orientation; any change must be regarded as exerting influence on much more than isolated systems. Designing such an infiltrated element is impossible; as indicated in the definition, this element regularly evolves because of organisational growth and innovation. Radical changes do not occur in a single dramatic rush; fruition requires time. The heterogeneity of information infrastructure components suggests that creating an electronic service for two structures demands relatively detailed knowledge about work practices. Design agreement on purely technological aspects is insufficient—an argument also holds true for sectors other than healthcare (Gasser 1986; Grudin 1988; Orlikowski and Lacono 1992; Suchman 2002).

Information systems in complex domains, such as healthcare, have long been incorporated into daily work in various institutions. As previously discussed, such incorporation forms a substantial installed base, of which EPRs are a significant part. GPs use EPRs in their practice; hospitals run composite systems that comprise hospital-based EPRs, laboratory systems, radiology systems and patient administrative systems. Many nursing homes have also introduced EPRs, and special-purpose systems are used by many emergency care units. From the perspective of information infrastructure theory, infrastructures are grounded on scalability and inter-operability standards. This means that constructing an information infrastructure without an overall understanding of interconnection will pose huge challenges.

4 Case selection

This chapter describes the public projects that make up the basis of my data collection. The projects represent the different strategies that Norwegian authorities have adopted since 2000. ELIN-k and Core Health Record 1 are projects operated with Lighthouse funding and managed by municipalities. ePrescription and Core Health Record 3 were established using earmarked funds from Parliament and managed by the Directorate of Health. Core Health Record 2 is an initiative of the hospital sector. Although it was not funded by the Directorate, the project was initiated because of the re-organisation of the hospital sector and the creation of the National ICT group for this sector.

4.1 ELIN-k

In 2005, the Norwegian Nursing Council initiated the ELIN-k project, which focuses on electronic information exchange amongst nursing homes, home care service, emergency wards, hospitals and medical offices (GPs). The goal of ELIN-k was to develop 13 standardised message formats that enable different institutions to communicate. ELIN-k was the first project that used standardised electronic messages in the municipal healthcare sector, both for internal transmission and exchange amongst divisions of the healthcare sector. The messages revolve around logistics, applications, medications and diverse information. As indicated in the February 2006 revised plan, the project was scheduled for completion in February 2008. The Norwegian Nursing Council and the Norwegian Association of Local and Regional Authorities were in charge of the project. The latter was an important actor because it represents the users and owners of the ICT solutions in the municipalities. The Nursing Council represents users at the occupational level. The inclusion of the Norwegian standardisation centre, KITH, was an essential step. Another requirement was for communication flow to be solidly integrated in the existing ICT tools in the healthcare sector. Therefore, seven vendors that render service to all the divisions in the healthcare industry signed contracts for participation in the project. Six municipalities wanted to run pilots. Funding for the project was a joint venture amongst the Ministry of Health and Social Care, Innovation Norway (the Norwegian Association of Local and Regional Authorities) and the Norwegian Nursing Council. The EPR vendors were to receive approximately 50% of the projected development cost. The entire package amounted to about €1.5 million. One of the

most essential messages included in the project is that revolving around medication information. The review of prescriptions was the first step in creating this information. Hence, prescriptions should also be the basis of the information that home care providers or hospitals need. This factor caused complications for ELIN-k because medication is also the essential component of the ePrescription project. Given that a standard was being developed, a common data model was necessary for the medication module. The main activities in the project were development, laboratory testing, approval, pilot testing, evaluation and adjustment of requirements. In the beginning, the specifications were comprehensively refined to create a description that developers can use as reference. A working method that involved user–vendor co-operation was adopted to enable the specification and adjustment of requirements. Several meetings and workshops were arranged and included users from the pilot municipalities and, at certain periods, the EPR vendors, who viewed these gatherings useful. The vendors were involved from the very beginning but were minimally active during the first two years. The work devoted to user requirements was more time-consuming than initially expected because of the changes in specifications and adjustment of standards. Considerable delay was also caused by a lack of resources on the vendors' part. The specifications for the first phase of the project and the communication between nursing homes and medical centres were completed in 2006, and the vendors were slated to deliver in spring 2007.

During the spring of 2009, one of the EPR vendors that supplied services to the medical centres and one that rendered services to the municipal sector delivered the EPR functionality, with the first message sent from one of the pilot sites. This transpired two years later than initially planned. Unfortunately, funding was used up in 2009, and not all of the formulated messages could be included. The EPR vendors positively regarded the manner by which the project was organised, with several of them evaluating it as the best public project in which they had participated.

4.2 Core Health Record 1, 2 and 3

The Core Health Record has emerged in three different versions during the last 10 years. The three actors that have managed these separate projects are (I) a municipality, (II) the Directorate of Health and (III) the hospital sector.

4.2.1 Core Health Record I – a municipality initiative

In 2007, the Trondheim city council received €650,000 in funding from the Directorate of Health to create a Core Health Record for the city council. The project aimed to reduce adverse medicine events and improve resource use in the healthcare sector. An immediate precondition was to integrate the Core Health Record with EPRs to create a user-friendly service. Patients' medication information is considered the most important component of the record.
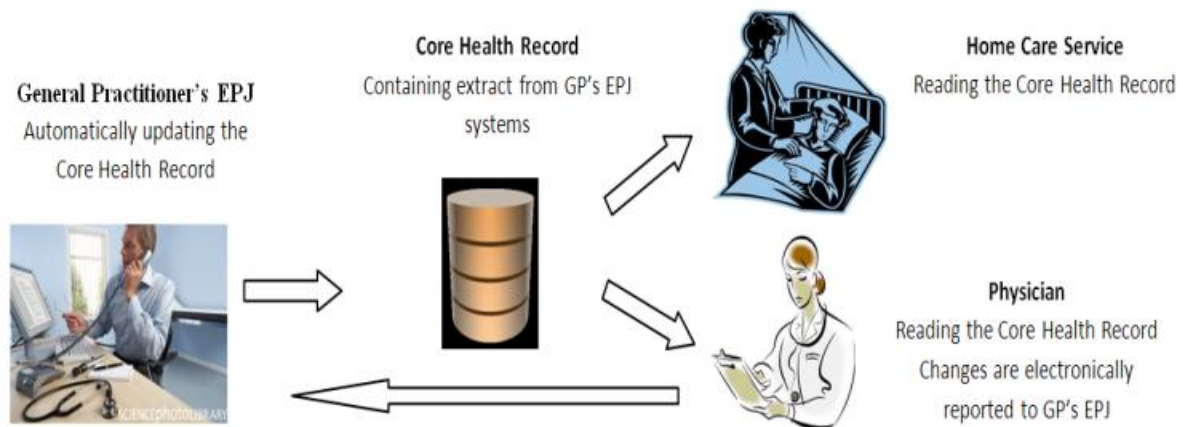
Figure 1: Municipal design

From a technical point of view, the Core Health Record service should consist of two major features: (1) read/write functionalities in EPRs and (2) a database containing the Core Health Records. The project team wanted to enlist as few EPR vendors as possible but was compelled to include all the EPR vendors and produce a national-scale solution because funding from Innovation Norway was unavailable otherwise. Additionally, the EPR vendors wanted to include national specifications in the service because the absence of such specifications would present risks for them. After an application process that spanned more than a year, the project received funding for expenses on integration work that the EPR vendors carried out.

User and technical workshops were arranged and specifications were further developed. The project was supervised by well-trained managers, but because of the complexity of specification work, experts from the Norwegian Centre for Informatics in Health and Social Care (KITH) were hired to run the process. The specification work on EPR integration was

difficult. Additionally, the EPR vendors failed to identify suitable specifications; they stated that the specifications were of a rather theoretical level, thus requiring explanation in a practical context before development could take place. None of the EPR vendors executed integration in their systems for the Core Health Record.

Meanwhile, Trondheim placed a limited tender and bought the database (item 2) that was based on pre-specified requirements. The database developer delivered and installed the database in the local area network of the municipality and claimed that it functions in accordance with the specifications. The city council, on the other hand, asserted that no sufficient documentation accompanies the database. The entire process was stalled and terminated in 2009, without the team conducting any kind of testing. A new national Core Health Record project, initiated by the Ministry of Health and Care Services, exacerbated the non-existent driving force for Core Health Record I.

4.2.2 Core Health Record II – a task for the Directorate of Health

The Core Health Record was an initiative earmarked by the Ministry of Health and Care Services, and the Directorate of Health oversaw the preliminary work initiated in 2009 and 2010. The project group consisted of 10 individuals: eight from the Directorate (including lawyers, technicians, a social scientist, an economist) and two practitioners who rendered work on an hourly basis (a GP and home care nurse).

The Directorate arranged several workshops and assembled a group of experts to collect information about needs and ideas regarding strategies for proceeding with the project. In January 2011, the Directorate submitted a pre-project report, which outlines that in the first version of the service, the source of information on medication should have been the information dispatched by pharmacies. By using a web service, health care providers can access their patients' prescription information. The Directorate viewed this approach as the most effective way to launch the service within two years. The report was sent out for review by the Ministry. Numerous recommendations from the respondents revolved around ensuring that the Core Health Record functions seamlessly with existing ICT tools; that is, it should be integrated with EPRs.

An important argument for excluding integration with EPRs was that the rollout of the first version of the Core Health Record should not have depended on commitment from the EPR vendors. A well-recognised problem was that the EPR vendors were a bottleneck in the

healthcare ICT development; the Directorate discerningly arranged the EPR integration along a 10-year schedule.
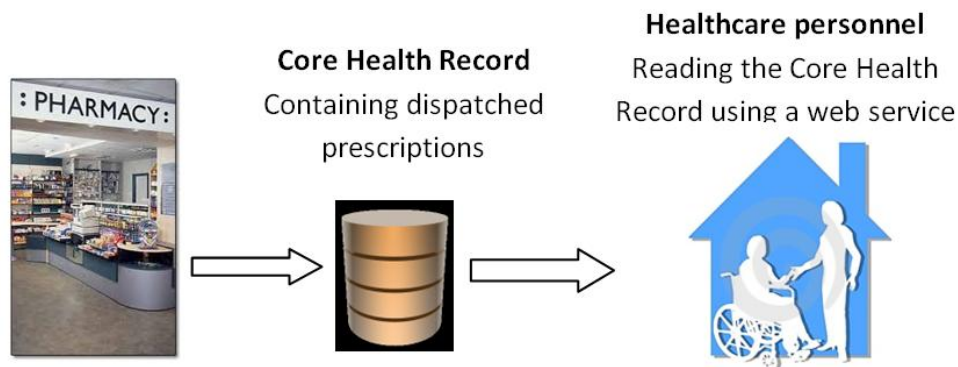
Figure 2: Design of the Directorate of Health

The healthcare sector responded with mixed enthusiasm. The Core Health Record received unfavourable reviews from the GPs, who listed the project at the bottom of the priority list during an opinion poll. The home care sector is required to inform clients/patients of the medication regime as soon as a physician changes this regime and not after medication is purchased from a pharmacy. The most positive response was that from the hospital sector, even though the Core Health Record was not optimised on the basis of the first version. Nevertheless, an ongoing project of this sector (i.e. the Central Medication Service) is similar to the Core Health Record, and these two projects can be interpreted as competing initiatives.

The mixed enthusiasm of the healthcare sector indicates difficult conditions for future work on the Core Health Record, but good funding may eliminate some of the obstacles. In 2011, €600,000 was allocated for the project and an additional €10.3 million was disbursed the following year. In Norwegian scales, such an investment is substantial.

4.2.3   Core Health Record III – a hospital sector initiative: Central Medication Service

The Central Medication Service that the hospital sector referred to in their consultation with the Ministry was the product of a sub-project that evolved from the ePrescription initiative, a project managed by the Directorate in its aim to have prescriptions electronically transmitted from physicians. The Directorate struggled in eliciting voluntary contributions from the hospital sector and was compelled to motivate the sector through the Ministry. Nonetheless,

because the hospital sector was experiencing problems with ICT-related issues, it did not consider the ePrescription project a priority.

One of the regional health authorities was eventually tasked to create detailed ePrescription requirements for the hospital sector. An essential stipulation was for work on the electronic prescription to be closely coordinated with the prescribing of medications in the hospitals. The hospital sector emphasised that they cannot introduce electronic prescriptions without reviewing the system in relation to internal prescription and medicine administration. That is, having one system for prescribing medication to hospital patients and another during the discharge process, would be unfavourable for the doctors. Additionally, ePrescription imposes the use of the 'Public Key Infrastructure', a requirement for which the hospitals would incur exorbitant costs and for which the physicians would incur increased workload.

The health authority in charge of creating the detailed ePrescription requirements for the hospital sector submitted a report in 2009 to the National ICT. The report outlines a plan for creating a central medication service that contains detailed information on the medication prescribed to a person/patient. The National ICT committed to contribute to refining the service. Funding was planned as a cost-sharing scheme between the four health authorities. From the perspective of a hospital, this service should be adapted in order to distribute and manage medicine to the hospitalized patients, including information on number of pills, time of administration, maximum number of pills per day and patient problems (e.g. taking in medication or difficulty taking the medication), amongst other important data. The Central Medication Service should enable the transmission of electronic prescriptions to satisfy the requirements of the authorities, provide services on demand, contain updated data and provide access to health care personnel (including GPs, home care providers and third-party providers that are involved in after-discharge processes).


Figure 3: Design of the hospital sector

These requirements are key even though the service was exclusively intended for the transmission of medication information, which is the most important component in the Core Health Record envisioned by the Directorate. Unlike the Core Health Record, however, the Central Medication Service was planned for integration into internal hospital operations.

4.3   ePrescription

In 2005, the Norwegian Ministry of Health and Care Service initiated the ePrescription project to create a service that replaces paper prescriptions with electronic prescriptions. This initiative was expected to be beneficial to pharmacies, physicians and patients. The most pressing argument for the development was that the authorities need a copy of all refundable prescriptions that are handled by pharmacies. The project received earmarked funding from Parliament, and the Directorate of Health managed the project.
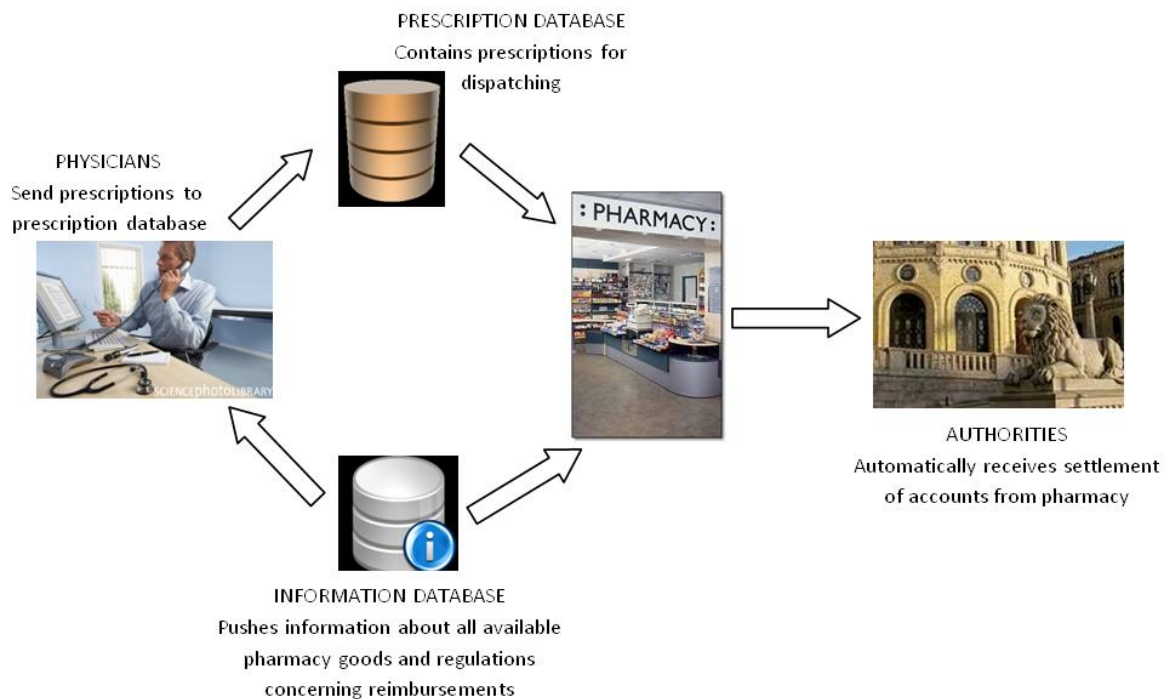
Figure 4: ePrescription service

A requirement was for the electronic prescription service to be developed as an integrated component of the information systems that already exist in the pharmacies and GP offices. The development process of the ePrescription project began with the establishment of a venture that comprised four sub-projects, with representatives of all user groups that were relevant to the new service. In addition to the Directorate of Health as project manager, the

main actors in the prescription value chain were the Norwegian Pharmaceutical Society (the trade organisation for pharmacies and pharmacy owners in Norway), National Insurance Administration (responsible for the reimbursement of government-paid medication), Norwegian Medical Association (representing GPs) and Norwegian Medicines Agency (disseminates all information concerning available medicine in Norway). The project had a budget of €30 million, which was several times larger than those allotted for similar initiatives. The high-profile nature of the project engendered considerable pressure to deliver results within deadlines. The project management therefore focused on excellent performance in relation to the budget and time schedule.

Specifications were developed as a result of a prolonged negotiation process amongst the user groups. Round table negotiations were held to discuss functionality on a principle level. Even though the representatives were familiar with the work practices at their respective domains, the specifications were prepared without close co-operation with users involved in day-to-day clinical operations and without an iterative development process. The project was intended to create a service that functions across organisational boarders and depends on integration with existing information systems, such as those in pharmacies, GP offices and hospitals. The vendors that should implement the service received a specification list, which provided few possibilities for collaboration with users.

The ePrescription project had a generous budget, but the money was intended for the public components of the endeavour. This allotment became a serious problem for the sub-projects that focus on physicians who prescribe medication; the physicians required the ePrescription service to be integrated with EPRs, indicating that project progress depended on co-operation with EPR vendors. After discussions between key stakeholders and the project owner, funding was disbursed for the acquisition of services from EPR vendors. In 2006, six major EPR vendors were invited to participate in the project. However, government funding and the Directorate's project plans, which promised benefits for all actors, were insufficient to mobilise the users, particularly the physicians, who could have exerted pressure on the vendors. The lukewarm reception amongst the users made the mobilisation of the central stakeholders difficult.

The hospital-based EPR vendors demanded more specific requirement specifications before signing a contract; thus, the development of electronic prescriptions in the hospital sector was postponed. Two of the three vendors that provide systems to GPs declined to participate because they were in the process of developing a new EPR, and manpower for their

development teams was limited. This limitation would have presented difficulties for the vendors in coping with the amount of work that the development of the ePrescription functionality required. Only the third vendor (which had a share of about 75% of the GP market) agreed to develop a pilot version. The vendor negotiated a payment that corresponded to 50% of the projected development cost.

The largest vendor in the GP sector developed the ePrescription functionality but with substantially more effort than first expected. ePrescription was integrated with a completely new EPR developed by the vendor and was installed in May 2008 in a small municipality. The new EPR was very different from the one that the medical office had used for years. It also suffered from numerous bugs, thereby making it unsuitable for professional use. All these problems constrained the work of the pilot users because they were consigned to test a considerably experimental software in a busy work environment. The ePrescription pilot was described as a 'living hell' by one of the participating GPs. Not surprisingly, the pilot was aborted after only three months. The vendor was forced to discard most of the ePrescription work because a new model was then defined for the service.

The pilot test of the ePrescription system in 2008 was evaluated as catastrophic given that the only vendor willing to provide an integrated ePrescription functionality failed. The project was slated for abolition. To motivate the two other EPR vendors in the GP market to participate, payment for integration was dramatically increased. Thus, the actors involved were able to mobilise a small but important part of the market (about 25% of the GP market) to take part in the ePrescription project. The improved payment scheme accelerated the integration process. In May 2010, a new pilot test was conducted and more positive results were derived. Nonetheless, the signing process was more bothersome than it had previously been and took longer to complete; doctors were compelled to work an extra half-hour or more each day. The two EPR vendors were, however, able to fine-tune their functionality in a way that customers found acceptable. The workload of secretaries in the GP offices, however, remarkably decreased because less interaction with patients regarding prescriptions was required. This situation meant that the GPs had to bear more of the workload in their offices.

In speeding up the process and rollout of the service, the strategy chosen was to develop a unit that can be used with the EPRs that were unintegrated with the ePrescription service. A small international company secured the contract to develop the integration unit. The integration unit was intended to cohesively function with the EPRs, with minimum effort required from the EPR vendors. The foreign company delivered in accordance with the

stipulations of the tender, after which the integration unit was presented to the EPR vendors. The largest EPR vendor for GP practices bundled the integration unit with its EPR and distributed the merged service to customers in accordance with the rollout plan outlined by the Directorate of Health. The GPs who used the EPR system with the integration unit experienced many problems. The prescription processing was troublesome, and the entire EPR system slowed down and became unpredictable. For some of the GP offices, the changes to their daily work were so inconvenient that they evaluated the situation as risky for patients.

The integration unit had predefined input and output functionalities and appeared as a black box (Latour 1987). Because of this black box, the EPR vendor could not fine-tune functionality between the EPR and ePrescription service. Responsibility for the entire product portfolio was entrusted to the EPR vendor once it delivered the integration unit bundled with the EPR. The EPR vendor received strong criticism, with all the objections directed against the EPR system and ePrescription service.

In November 2012, 90% of the GP offices in Norway were technically able to transmit electronic prescriptions. Of these offices, 60% used the ePrescription service, indicating that approximately half of the Norwegian GPs sent prescriptions electronically at this time. Through the ePrescription project, the authorities receive an electronic copy of required prescriptions, which are sent directly to their information system for further processing. This achievement aligns with the preliminary goal. By contrast, the physicians encountered problems. The GPs who used the free ePrescription integration unit, a work day became considerably longer. As previously mentioned, some of the workload in the medical offices was shifted from the secretaries to the physicians because of the new prescription process.

5 Method

This chapter describes the method adopted in this study. It begins with my approach to the empirical investigation, in which I describe my initial design, the adjustments to and expansion of data collection and the theoretical basis used to answer the research questions. I then elaborate on my position as a scientist, including how my perspectives may have influenced my findings, analysis and conclusions. I discuss the data collection and analysis method and provide my reflections regarding my role in the health sector.

5.1 Approach to the field of interest

Information system research can be classified as interpretive if we assume that our knowledge of reality is gained only through social constructions, such as language, consciousness, shared meanings, documents, tools and other artefacts. Interpretive research does not predefine dependent and independent variables but focuses on the complexity of human sense-making as a situation emerges (Kaplan and Maxwell 1994). It attempts to understand phenomena through the meanings that people assign to them (Boland Jr and Day 1989; Orlikowski and Baroudi 1991; Deetz 1996). Interpretive methods of research on information systems are 'aimed at producing an understanding of the *context* of the information system, and the *process* whereby the information system influences and is influenced by the context' (Walsham 1993). Under such goal, interpretive studies help researchers understand human thought and action in social and organisational contexts; it has the potential to produce profound insights into information systems phenomena, including the management and development of such systems (Klein and Myers 1999).

The relationships amongst people, organisations and technology are not fixed but constantly changing. Thus, interpretive research seeks to understand a moving target. Insofar as each instance is treated as a unique historical occurrence, interpretive research is idiographic (i.e. it describes the effort to understand the meaning of contingent, unique and often subjective phenomena) (Klein and Myers 1999). All kinds of understanding are related to the context and situation within which an issue is analysed.

Along these lines, Haraway (1991) believes that the only viable task is to view knowledge from a specific context and contends that we operate under the false impression that a researcher can examine a situation from outside and detach himself/herself from research

objects. If researchers can indeed position themselves in this manner, Haraway (ibid) argues that we can imagine ourselves as omniscient and omnipotent individuals—a phenomenon that the author calls the 'God-trick'. The God-trick pertains to the ability to view everything from nowhere. Haraway maintains that because we are not gods, we must recognise that we need to examine knowledge from a specific position, and that such position affects the type of knowledge that we produce. The importance of objectivity and epistemology is an equally central issue in Klein and Myers' (1999) article, '*A set of principles for conducting and evaluating interpretive field studies in information systems*'.

The intellectual basis of a research design provides the lenses through which field data are construed, documented and organised. Research findings may not support preconceptions and may therefore require modification or abandonment. This process is one instance of the hermeneutic rule that states prejudice, prejudgement or prior knowledge plays an important part in our understanding. In positivist social science, prejudice or prejudgement is viewed as a source of bias and thus a hindrance to true knowledge; according to positivism, objectivity is best attained if a social scientist adopts a value-free position and prevents biases from interfering with his/her analysis. By contrast, hermeneutics recognises that prejudice is the necessary starting point of understanding.

Klein and Myers (1999) stand by the philosophy that Gadamer (1976) represents in dealing with this issue and argue that the critical task of hermeneutics then becomes one of distinguishing between *'true prejudices, by which we understand, from the false ones by which we misunderstand'* (Gadamer 1976). The suspension of our prejudices is, of course, necessary if we are to begin to understand a text or text-analogue, but as Gadamer points out, such suspension does not mean that we simply set aside our prejudices. Rather, it means that we as researchers must become aware of our own historicity (Gadamer 1976).

In interpretive case studies, one typically asks 'how' and 'why' questions in a complex field. According to Yin (2009), a case study presents a distinct advantage in such circumstances: *'For a case study this is when a how or what question is being asked about a contemporary set of events, over which the investigator has little or no control'*. Yin (ibid.) also maintains that a multiple-case study is preferable for research that focuses on a 'why' question.

Data collection in interpretive studies is generally carried out in several ways to enhance credibility. Interviews with key actors within an area of concern are a crucial information source, but document studies and participation in workshops and meetings are equally

valuable. This combination is a form of triangulation, in which several methods are used to examine a single phenomenon. Jick (1979) states that triangulation endows data with considerable credibility and increases the possibility of deriving unique findings. The author also claims that triangulation enables a clearer understanding of a research question.

This kind of triangulation is crucial to the 'development and implementation of inter-organisation ICT tools in Norwegian healthcare' because the issue is extensive and complex; it is difficult to delineate and is an inconspicuous avenue from which to obtain sustainably scientific data given the scale of the projects that fall under this domain.

5.2   Study design

My overall case is Norwegian healthcare, and I investigated how inter-organisational ICT tools were developed and why good results were difficult to achieve. The large-scale nature of the case necessitated breaking it down into smaller representative sub-cases. I chose three projects for which inter-organisational healthcare ICT tools were developed; these projects were initiated around 2005. The three projects were supported by Norwegian authorities and were assumed to accord with the Norwegian eHealth strategy. No other projects of such scale were ongoing at the time I began collecting data. I included the project that I had participated in, namely, the Core Health Record project (Trondheim municipality initiative), for which the stakeholders struggled to achieve some success. The second project that I investigated is the ePrescription project, which was aimed at developing a service that uses electronic prescriptions. Project three is the ELIN-k initiative, which was designed to establish electronic communication between the home care sector and GPs and hospitals.

Even though I was thoroughly familiar with the Core Health Record, I interviewed several other project members and the project manager to obtain detailed information from different perspectives, especially with regard to co-operation with vendors and how the authorities acted in terms of coordination and control. During the study, the design was slightly modified following Yin (2009); such re-design is common during data collection. I included interviews with relevant point persons and carried out document studies that are not directly related to the three projects. A guiding principle, however, was that my data collection should cover the overall case to acquire knowledge on either the project providers, vendors and users or the bureaucracy.

5.2.1 Collecting data through interviews

Interviews are similar to conversations; they are dialogic contexts wherein the negotiation of meaning and knowledge is generated. Each interview builds a knowledge base that increases during the data collection period. The first interview in a series of several establishes the context for the next session. The completed interviews affect the next interview because new knowledge extends context. Under such a situation, an interviewer is influenced by respondents, thereby presenting changes to the way questions are asked and the issues that the interviewer is attempting to elucidate. If a researcher is receptive to this process, then he/she relinquishes some control over the research process. At the same time, the researcher becomes more visible in the conversation. Mol (2002) points out that a researcher should determine whether the interactions that occur between researchers and research subjects are positive or negative. According to Latour (2005), the actors involved in research are the ones that determine what factors are important. In Latour's approach, influence from respondents should be considered a positive occurrence.

When a researcher invites respondents to share reflections about a research issue, he/she is exposed to the respondents' explanations of phenomena. In this context, the respondents act as analysts. Such open conversations between interviewer and informant clarify that analysis takes place not only after the interview, but also during the interview as interaction between the two parties. As Klein and Myers (1999) put it,

> *[i]t follows from this that interpretive researchers must recognize that the participants, just as much as the researcher, can be seen as interpreters and analysts. Participants are interpreters as they alter their horizons by the appropriation of concepts used by information system researchers, consultants, vendors, and other parties interacting with them, and they are analysts in so far as their actions are altered by their changed horizons. This effect is lessened if the researcher is not interacting with the participants, i.e., relies solely on historical secondary data or a concealed one-way window.*

The opinion above is also reflected in Haraway's (1991) statements. The author is directly opposed to a dualistic view because this perspective relegates a research subject into a passive resource that researchers can exploit. Haraway (ibid) emphasises that research subjects should be represented as partners and actors, so that the narratives concerning a

theme will arise not from a discovery logic, but from conversation wherein negotiations of meaning occur between researcher and respondent.

5.3   Data collection

The data collection period was divided into two separate time scales. The first spanned 2004 to 2009, during which I was a project member of a publicly funded project. For this initiative, we attempted to create a new service and were confronted with the challenges that come with such initiatives. The second data collection period spanned 2009 to the completion of this thesis. Given the data collection period chosen for this research, it counts as a longitudinal study (Pettigrew 1990). Pollock and Williams (2010) recommend a longitudinal approach because it enables the understanding of the current and ongoing difficulties encountered in the development of large-scale health infrastructures.

The research material comprises a substantial amount of data derived from a number of settings and different forms of data collection. The main categories are interviews, participant observations and document studies.

5.3.1   Interviews

I carried out 42 interviews, which were semi-structured and included sessions with a project member, vendors, policy makers and public authorities. The semi-structured interviews were non-imposing, as well as natural and spontaneous, opportunities for interaction between the respondents and myself as a researcher. I contacted the individuals with whom I wanted to hold sessions mostly via e-mail, but I also called them on the phone or personally scheduled interviews whenever I was given an opportunity to personally converse with potentially interesting respondents. The most typical interview lasted about 60 minutes, and the shortest and longest lasted 20 and 160 minutes, respectively. I presented the purpose of the interview and explained my intentions. With a few exceptions, the interviews were recorded and all the recordings were based on the concepts highlighted by the respondents. The interviewees were also assured of confidentiality (i.e. only my supervisor and I listened to the recorded interviews). One of the respondents declined to be recorded because at the time, he was involved in a procurement process, which prohibited recording. This interviewee was also the only individual who brought a lawyer, also in accordance with the procurement policy. For

three of the interviews, I was compelled to take notes because my recorder malfunctioned. Some of the respondents specifically asked for right of approval in case their statements are cited in my articles. The interviewees responded to my requests in a very positive manner and most of them immediately agreed to an interview. I believe that my background as an insider (Klein and Myers 1999) afforded me easy access to the respondents; this access was freely given partly because I had met several of the respondents during my participation in the Core Health Record project and partly because I was able to reveal good insights when I described my research. Several of the respondents directly stated that 'it is about time that someone look into this field and document what is going on'.

The respondents freely expressed themselves, except for one interviewee, who instead referred me to the project manager.

Interview subject	Category	Number of interviews
Project member	Projects: Core Health Record, ePrescription and ELIN-k	12
Health care worker	GP offices, pharmacies, hospitals, municipalities	18
Technical personnel	EPR vendors	8
Consultant	From various institutions	4

Table 3: Overview of interviews

5.3.2 Document studies

The study objects are the funded projects and the framework within which these projects were implemented. Information on these matters is, in principle, available to the public, as stipulated in Norwegian legislation. The public sector in Norway has published a considerable volume of information on the web. Thus, the Internet has afforded me access to the following documents:

- strategic ICT documents and evaluation for Norwegian health care for the period 1997 onwards
- project documentation of four national ICT healthcare projects

- minutes of Parliament meetings
- Texts of speeches by the Minister of Health and Care Services
- Management documents from the Ministry of Health and Care Services
- Minutes of meetings between the Ministry and Care Services and regional health authorities
- Minutes and case documents of meetings of the National ICT
- Homepages of the Ministry of Health and Care Services and Directorate of Health
- Newspapers
- Webpages on international trading agreements

5.3.3 Observations

Important information sources for this study were the members of the Core Health Record project. I define the data I collected in this manner as 'observations'. During my time as a project member and afterwards, I participated in numerous workshops arranged by different public organisations and one event arranged by a user organisation. I also observed the first and third week of piloting of ePrescription in Os municipality in 2010. The number of observations conducted and the documentation method for the observations are listed in Table 4.

Observation	Documentation
3 years of project work (Core Health Record project)	Minutes of meeting E-mail correspondence Personal notes
Participation in 18 workshops on ICT in Norwegian healthcare	Minutes of workshops Recordings from five of the workshops Personal notes
80 hours of non-participant observation at GP offices and pharmacy (ePrescription)	Detailed field notes

Table 4: Overview of observations

5.4   Data analysis

My qualitative research produced voluminous data, similar to what other researchers in this field have accumulated. Every observation, document study and interview shed light on new information. The purposes of the material analysis were to systematise, organise and compress the data and to develop interpretations of the findings. A particular challenge in qualitative data analysis is that examination and interpretation are often simultaneously undertaken: in compressing data, one also performs an interpretation. The analysis was a continual task that spanned the data collection period to the completion of this thesis.

An important principle of hermeneutics is the necessity of understanding a totality on the basis of particularities, and vice versa (Schleiermacher 1977). The hermeneutic circle involves continuously fluctuating shifts in understanding particularities and totalities. Every particularity relates to other particularities and to a totality; a particularity changes and differs after an idea is perceived from a new angle. The totality changes when particularities take on new meaning.

My interpretations served as a theme in several discussions with my colleagues in information systems and my supervisor. These discussions strengthened my confidence that my analysis of the situation has a robust foundation. Given the long time scale of the study, important events were arranged on a timetable to enable understanding of the contexts of different events and how they have influenced one another. Examples of these events are the re-organisation of the hospital sector, introduction of new legislation and publication of new political strategies.

5.5   Reflections – moving from Newton's laws to qualitative research

This study was a long journey for me because of my technical background and the fact that involvement in the health domain has been my ambition for several decades. From about 2004, I became a member of a project group that aimed to build a Core Health Record, and working with health care professionals taught me the necessity of including a sociological perspective in my work. I obtained funding for participation in a PhD programme that would allow me to study the effects of this new service, and the disappointment was significant when the project was terminated without any piloting. This situation prompted me to ask why establishing the service was so difficult. I pondered over what could have been done

differently and why the healthcare sector lagged behind other industries in terms of adopting electronic co-operational tools. These questions constitute the basis of my newfound focus in my PhD study.

As a former project member of a failed national project, I obtained inside information (Walsham 1993) and valuable insight into the processes in question. My position in the Core Health Record project afforded me the opportunity to closely monitor the project process and acquire insight into the ELIN-k project given the association between the two initiatives (we arranged several co-operational meetings). During the project period, we also received regular reports on the ePrescription project because our project manager engaged in dialog with the ePrescription proponents. At an early stage, therefore, I acquired significant information on all the three projects. My being an insider also endowed me with easy access to key actors who would otherwise have been difficult to arrange appointments with.

Being involved in a project that subsequently became my object of study allowed me to realise that I have accumulated a set of prejudices regarding the project. I strived to achieve an objective perspective in the way I approached the field of interest. Throughout the entire study, I continually collected and analysed data, was transparent about my background and attempted to complete my work in accordance with Gadamer's (1976) model. For instance, I possessed a good understanding of what transpired in the project that I participated in but lacked the insight that the other project members had acquired. A crucial requirement, therefore, was to inquire into their perspectives to enhance the objectivity of my approach. In the interviews, I focused on obtaining the respondents' opinions, experiences and reflections instead of underscoring 'hard facts'. As previously stated, only one of the respondents was reluctant to freely offer his standpoint and instead referred me to a project manager.

As a situated researcher, I brought to the ethnographic environment not only analytical methods, but also a personal biography, which has influenced my research. I do not deem this contribution an obstacle to objectivity but a resource that facilitates my understanding. Interviews that were initially perceived as conventional question-and-answer sessions became, in the end, conversations during which the respondents and I exchanged opinions and experiences. Such exchange was possible, to a certain extent, to the fact that the respondents were informed of my background beforehand and during the interviews. All the respondents also knew about the significant problems associated with the completed ICT projects in the health sector. The respondents wanted to hear about my experiences and they shared their own; this process enabled us to discuss how the ICT projects were completed and

the problems that emerged—issues that were central to my study. With the respondents who had the time and opportunity, the interviews exceeded the pre-determined scheduled of 30–60 minutes, but in such sessions, the respondents became partners and actors, in correspondence with Haraway's (1991) views on the active role that respondents should play in interviews.

My perceptions on the research issues were re-examined throughout the data collection and analysis process. A shift in understanding occurred when I transitioned from being a project member to an individual intent on comprehending the climate and preconditions that characterised the Core Health Record. The factor that slowed down progress in the development of co-operational tools was completely different from what I had at an early stage. After initially ascribing the problems and delays to the vendors, I increasingly realised that the challenges were much more complex; they involved interests, relationships and interdependencies amongst many stakeholders.

The interviews served as a rich and pluralistic knowledge source. The information I derived was transcribed and organised into themes. Combining all the informational elements paved the way to my comprehension of the viewpoints of the different actors and how these views have affected progress in the sector. The perspectives of the users (health care personnel that use the information systems), EPR vendors and authorities are presented in the form of a synthesis statement in the case description to facilitate the visualisation of the complex situation.

My analysis revolved around identifying meaningful patterns on a higher plane by investigating the relationships amongst my information sources and by determining the similarities and differences amongst the data I collected. Qualitative research often seeks to problematise an issue. Amongst the numerous tasks that I completed, I problematised a project that I was involved in and critiqued my own and my project colleagues' work. In the beginning, I was somewhat discomfited by these tasks because I could end up harshly evaluating myself and my colleagues. This concern turned out to be unfounded because the study process allowed me to recognise the complexity of the situation and the fact that the problems cannot be attributed to the individuals involved but to the superior system at work.

6   Findings

The five articles were a product of a 6–7-year analysis of inter-organisational ICT development in Norwegian healthcare. Several project studies form the empirical basis for the articles. The articles also examine the manner by which Norwegian authorities attempted to advance development in the desired direction in terms of strategy, as well as management and control in some cases. Furthermore, the articles look into how Norwegian and international political philosophies influence the development of ICT in Norway.

The five articles are as follows:

6. Larsen, E. and G. Ellingsen (2010). Facing the Lernaean Hydra: The nature of large-scale integration projects in healthcare. In Kautz, K and Nielsen P.A. (eds.): *First Scandinavian Conference on Information Systems*, SCIS 2010 Rebild, Denmark, August 20-22. Lecture Notes in Business Information Processing, Springer: Vol. 60, 93-110.
7. Larsen, E. and LK. Johannessen (2014) Top-down or bottom-up? Building information system for healthcare. Submitted to: *Journal of Medical Internet Research.*
8. Larsen, E. and G. Ellingsen (2012) Establishing a Core Health Record: A case study from Norwegian healthcare. Dugdale, J. et al. (eds.), *From Research to Practice in the Design of Cooperative Systems: Results and Open Challenges*: COOP 2012 Marseille, France, May 30 - 1 June, 2012, Proceedings of the 10th International Conference on the Design of Cooperative Systems, Springer: 1-15.
9. Larsen, E. and PK. Mydske (2013) Developing electronic co-operation tools: A case from Norwegian healthcare. *Interactive journal of medical research* 2(1): e9.
10. Larsen, E. and G. Ellingsen (2014) Nothing free about free market. Rossitto, C. et al. (eds.), *COOP Proceedings of the 11th International Conference on the Design of Cooperative Systems*: COOP 2014 Nice, France, May 27 – 30, Proceedings of the 11th International Conference on the Design of Cooperative Systems, Springer: 69-85.

The papers are presented in chronological order, corresponding to the periods at which work on the papers was initiated. In particular, article 2 was subjected to a complex review process because obtaining feedback on it spanned 2.5 years. This paper was recently re-submitted to a new journal.

All the papers are related to one or some of the three study cases but were drafted with different approaches. Additionally, article 2 includes a case that a colleague in our research group studied. Because the data collection lasted several years and different levels of progress were achieved, the volume of empirical data also varies.

The papers are theoretically interconnected, and information infrastructure theory served as the core support throughout the study. The other supporting theories referred to are also

related to a socio-technical mindset, except for the social economic theory that I introduced in article 4. I adopted this theory because of my need to understand the political paradigm. For this article, I invited an expert in the healthcare domain to share his expertise in order to reinforce the analysis.

The succeeding sections present a summary of the five articles.

Article 1 - Facing the Lernaean Hydra: The nature of large-scale integration projects in healthcare

Despite initiatives and actions, only minor steps have been made towards creating improved communication systems in Norwegian healthcare. The first article empirically examines this issue on the basis of the three Norwegian healthcare projects launched in 2005. The projects were initiated and funded by the Norwegian government and were aimed at establishing inter-organisational electronic communication in the healthcare sector.

This article provides insight into the project processes and serves as basis for discussing major issues that influence the climate that surrounds the development of seamless electronic communication in the healthcare domain. It also examines the nature of the projects and elaborates on how they tended to progress, overlap with one another and increasingly become mutually interdependent. For instance, patients' medication information is critical to all the three projects, and the vendors required a uniform way to treat this data. Moreover, the proponents of the projects were compelled to enter into an agreement with the same vendors, a situation that caused interdependence and a bottleneck.

Another major problem discovered is that the authorities expected the vendors to sign development contracts that stipulated a fixed closing date and a limited budget but still demanded an agile and dynamic development process. The paradoxical consequence is that the vendors were driven to demand additional pre-specifications from the authorities to avoid monetary losses due to emerging user demands and unforeseen circumstances. As a result, the stakeholders contributed to a spiralling self-reinforcing process, wherein everybody demanded detailed requirement specifications upfront, which in turn, caused delays. This unfortunate process is bound to continue when the new system is applied in practical settings. Although the vendors delivered in accordance with high-level requirement specifications, the

software has not been tested, and whether the new system accords with existing work practices remains uncertain.

Another issue highlighted in the article is that the vendors realised that funding for the public projects accounts for a relatively small proportion of the development cost. Because the new integrations were projected to only minimally increase the vendors' market share, they perceived few benefits of participating in the process. Accordingly, when vendors need to prioritise amongst different development tasks, they accord preference to assignments from primary customers because such initiatives ensure a steady cash flow. At the same time, however, this practice placed the vendors in the unfortunate position of being regarded as the core reason for the major delays in the projects.

I concluded that development in inter-organisational settings requires a step-wise approach with substantial influence by (actual) users. Early co-operation between developers and users result in detailed specifications and enable users to understand the service that is being developed. A service that is developed in such manner also encourages users to adopt a solution if it adds value to their work; value translates to a service that they are willing to pay for.

I also argue that a model that is almost fully funded may be necessary to enable significant progress in similar projects in case users are unwilling to commit in early development phases. Alternatively, the authorities can channel funding to users in order to convince the vendors to participate even before the authorities express a request. Taking advantage of the vendor–user relationship is favourable because vendors are more loyal to their customers than to the authorities given the stable income that they earn from the former.

Article 2 – Top-down or Bottom-up? Building information system for healthcare

For the second article, I compared a large-scale top-down project with a small-scale bottom-up project in Norwegian healthcare. The projects aimed to establish inter-organisational services with integration to the existing bases in the organisations involved.

The two cases adopted completely opposite approaches to project organisation. The ePrescription project was an ambitious top-down project initiated and financed directly by Parliament. It was part of governmental plans for electronic communication in healthcare and motivated by the health authorities' need for financial control of medication distribution in the sector. It was organised by top-heavy management in the Directorate of Health. The

Interactor project, on the other hand, was a typical bottom-up endeavour that adhered to but not initiated directly on the basis of national plans for innovation and healthcare. It was motivated by a hospital's need of such a system and the vendor's expectation of a potential market. It began as a small collaboration project that involved local actors and was of a small scale in all aspects: budget, time frame, project organisation and with resources directed to development and not to administrators, advisers and consultants.

In its analysis of the ePrescription project, the article shows that this project may be perceived as being governed through networks of independent units, where decisions are the result of negotiations and where public managers assume a purely coordinating role. The manner through which it was managed, however, did not accord with the context of a changing environment and did not directly involve users as co-producers in the development phase. The ePrescription project appeared to more closely align with one of the main trends in public governance today, in which increased focus is devoted to managing the financial and time risks presented by government activities. The ePrescription case demonstrates how unanticipated events and processes occurred, how systems failed to work as planned and how all these problems resulted in overrun budgets, major delays and unsatisfied users. By contrast, the Interactor project evolved with equal participation from the vendor and users. It was immediately implemented, thereby providing the users with added value. Despite the fact that it was an innovation for which development was still ongoing, it drew attention from potential customers, and in a relatively short period, was sold to a number of hospitals. This progression conforms to a growing information infrastructure. Given public procurement regulations, however, further expansion in the market was delayed for years, ultimately transforming the evolving bottom-up progression into a top-down process.

This article also compares and analyses the development models employed and how the different forms of user participation progressed in the two projects. The sequential waterfall model (Royce 1970) and the iterative agile model (Beck 2000) were used in the ePrescription and Interactor projects, respectively. These models represent two different approaches to information systems development. The waterfall model assumes a stable environment and disregards the need to change requirements, whereas the agile model considers the environment uncertain and welcomes requirement variability. Despite these differences, the testing periods for ePrescription and Interactor shared considerable common ground, even though the former was slated for completion when it was launched for pilot testing. All the explorations, workarounds and periodic development of new versions of the system that the

ePrescription pilot users (especially in the pharmacies) experienced closely resemble the process encountered by the Interactor pilot users, although for the latter, such processes proceeded in a shorter period. These similarities suggest that even with large pre-specifications, avoiding the experimentation phase that is characteristic of agile methods is impossible.

The conclusion suggests taking on a middle position on the organisation of a large-scale integrated information system. I believe that in real-world settings, a step-by-step strategy is preferable but that this approach requires good conditions for continued growth. I argue for a project organisation governed through networks of independent units, where negotiations are results-oriented, where public managers take on a purely coordinating role and where a development model that resembles an organic model (Tyworth 2006) is used. This approach acknowledges that contexts are variable, that government bodies are only one of several equally involved units in a network, and that the role of a public body is facilitative rather than authoritative and regulative. In contrast to the Interactor approach, this recommendation ensures high-level anchoring, thereby endowing the process national support and guaranteeing coordination in welding sub-systems into one coherent service. The development processes must be agile but must simultaneously serve overall integration goals and plans. A system can be constructed beginning with a simple solution for a few user groups and followed by the incorporation of complex features and users in an evolutionary manner.

Article 3 - Establishing a Core Health Record: A case study from Norwegian Healthcare:

The third article shows the approach to three different projects run by a municipality, the authorities and the hospital sector in the aim to create the Core Health Record (also called Patient Summary and Central Medication Service). During the last 10 years, the authorities have modified their approach to influencing ICT development in the healthcare sector, and the descriptions of the three projects in the article shows the different strategic measures adopted by the authorities. Some of the key features of the projects are as follows:

1. The municipal project was partly funded by the authorities, but the authorities did not serve as coordinator or mediate in project management in any way. The project was launched in 2005 and terminated in 2009 after failure to achieve its targets.

2. The authorities' project was financed with earmarked funds from the government, and the authorities function as project managers. The project was initiated in 2010 and was still ongoing in 2012.

3. The hospital sector project was financed and managed by the sector itself. Project launching was achieved particularly because of a new structure and a succeeding ICT strategy implemented in the hospital sector. It was initiated in 2010 and was still running in 2012.

The article provides insight into the project processes and provides basis for discussing the way strategic changes have influenced ICT development in Norwegian healthcare.

First, the article shows that management was moved to the Directorate level because the previous initiatives on establishing sustainable electronic services had failed. The authorities assumed a leading role in hopes that this strategy will enable them to manage the problems. By using reference groups as consultants and managing the project via the Directorate of Health, the project considerably deviated from a user-driven development philosophy, thereby causing a huge gap between the designers and user groups.

Second, the article demonstrates how the hospital sector became an influential actor capable of setting an agenda for ICT development in the entire healthcare sector. Even though the driving force of the 2011 Core Health Record was management by the Directorate, the other initiatives operated by the hospital sector appeared to compete with the project. In fact, the hospital sector seemed to possess a more powerful position than did the Directorate, not only because of the number of users that the hospital sector represents, but also because of their close relationship with the EPR vendors—a relationship that represents an obligatory passage point (Latour 1987). This relationship also points to the hospital sector's ability to establish agenda for ICT in Norwegian healthcare. Such influence, however, may be unfavourable because it relegates (for example) the GPs to the background, even though these physicians' practice serves as a hub for the electronic flow of patient information in Norway.

I concluded that the authorities shifted roles, from being a supporter (by allocating funds to projects at a low level in a health organisation) to being a designer (by being in charge of the design process and implementing a new service). The authorities' influence seemed to increasingly separate the users from the system developers. In future processes, this separation should be re-considered and more user-friendly and efficient systems must be developed. The authorities should identify methods for closing the user–developer gap by

bringing them together in innovative processes. Numerous resources that are spent on consultants who draft papers can be better spent on system developers and test users.

Article 4 - Developing electronic co-operation tools: A case from Norwegian healthcare

The fourth article aimed to determine how the authorities' financing policy influences the development of electronic co-operational tools for healthcare. It presents two case studies (the Core Health Record municipality initiative and ePrescription) and sheds light on the different perspectives of health care customers, vendors and authorities in terms of how they experienced the development of inter-organisational electronic communication. The article also describes why the EPR is a product that is essential to inter-organisational communication and how, under this backdrop, equating this product with ordinary consumer products is difficult. The essential features of EPRs are as follows: (a) they are seldom replaced by customers, (b) they are obligatory passage points in the interchange of patient information and (c) EPR vendors act as gatekeepers in the development of electronic co-operation in healthcare systems.

I also found that Norwegian authorities interfere in the EPR market in such a way that low priority is accorded to customer requests. EPR vendors are typical commercial actors that must earn a profit. Customers' wish lists regarding improvements in EPRs are always considerably longer than a development department can handle; thus, the choice of which items on a list to accommodate is always a matter of priority. The authorities' interference in the relationship between EPR vendors and their customers has consequences for EPR development, both in terms of functionality and priority. The authorities powerfully influence EPR development in two ways: through regulation and through funding. With regard to influence through regulations, vendor contracts with their health care customers obligate them to change an EPR system in accordance with new regulations introduced by the government. Every time the authorities modify required information, the EPR system must be changed to collect or assemble the necessary information. As for influence through funding, the authorities can purchase the functionalities that they deem a priority by contacting vendors. Depending on the amount of funding, prioritisation by the EPR may favour the wish lists of the authorities over those of their customers. When the authorities interfere in EPR

development by imposing regulations or offering well-paid assignments, the EPR vendors are motivated to shift attention to the authorities' requests at the expense of the customers' requests. In this manner, the authorities interfere with a complex market and act contrary to political philosophy that favours unregulated market capitalism.

Another interesting finding is that regarding the market mechanisms that underlie the issue in question. Norwegian authorities' approach to the ICT market is grounded on a principle that insists on placing public purchases on a tender for efficient use of public funds; grants intended for the development of a new functionality do not fit into this philosophy. In the projects examined in this article, good funding was an exception. The idea is that the product should be attractive to users and create income through new sales and increased license income. A problem is that vendors often find the effort required for development to be considerably more substantial than initially estimated and funding to be insufficient (see article 1). When the development of new services or functionalities requires co-operation with other vendors, control over the development phase dramatically decreases. That is, the vendors are compelled to bear an economic risk in developing electronic co-operation in the healthcare sector—a risk that they are not willing to take. From a customer's perspective, purchasing unfinished co-operational functionality is a perilous option for health care institutions because investing money in an innovation of unknown utility that may take years to develop is impractical. This difficult situation for vendors and customers results in sluggish progress in the development of co-operational tools for healthcare. Nevertheless, the authorities have been willing to provide funding for public projects that are intended to develop new collaboration tools for the sector. Projects aimed at realising this goal have been established and co-operational tools have been specified. For these public projects, an emerging issue is the extreme difficulty in convincing EPR vendors to participate given the situation described in the previous section. If EPR vendors do not believe that a new functionality will earn them income, development will be postponed. Thus, the money invested in public projects will be spent on planning and specification, without development actually taking place. These projections suggest that the market mechanism on which the authorities rely is non-existent in the current healthcare development landscape in Norway. My findings may be generalisable to other sectors. I propose that the authorities undertake a coordinating role and finance this type of development because regular market mechanisms are non-functional. A critical requirement, however, is for the coordinating role to be

achieved in collaboration with actual users. The users must serve note merely as consultants but as decision makers.

Article 5: Nothing free about free market

This article elucidates the effects of the different strategies that Norwegian authorities have adopted in enlisting users and vendors to establish electronic prescriptions as a new national routine service. The case description highlights how stakeholders responded when the authorities needed integration between the new service and the information systems that physicians use in their daily work, namely, the EPR.

The key analytical points of this article are summarised as follows. First, a strategy that focused mainly on the vendors caused difficulties in mobilising users. The vendors' focus deviated from their customers' needs and shifted to those of the authorities, which expressed their need for electronic copies of prescriptions for reimbursement purposes. Second, by providing EPR funding that equalled that of the ePrescription project, the authorities positioned themselves as the 'real' customers of the project. Hence, they acted in opposition to the philosophy of user-driven development of information systems. Third, the integration unit that the authorities developed was not robustly embedded in the existing infrastructures, and here, the authorities acted in opposition to their previously established strategies.

In sum, the EPR is the most important information system that health care institutions use. These systems have been evolving through years of improvement. In a country such as Norway, which has very few vendors, the EPR market is a very small and dedicated one. Any influence on this market from a powerful vendor, such as the authorities, will affect the market in a significant way. The authorities that are key players in this market should not underestimate the negative effects that may arise from a change in EPR functionality, regardless of whether the intentions are positive for all stakeholders.

Early hands-on experience is crucial for realising good and well-adapted EPR functionality. Users should be able early on to determine how a functionality works in correspondence with existing work practices, and they should be able to provide feedback during the development process in such a way that the new functionality can offer added value to users. This goal is

difficult to accomplish for inter-organisational services, as in the case of the ePrescription project. By breaking down a service into smaller modules, however, the effects are more easily recognisable. The project development could have begun with a module implementation strategy as a means of mobilising users.

7   Implications

The main contribution of this thesis is the empirical insight into the prolonged effort to establish an inter-organisational service in the primarily publicly funded Norwegian healthcare sector. Even though the empirical target is a specific sector of a small country, this study presents several implications that may be equally valid in other sectors and countries.

My main research question encouraged me to formulate recommendations that may accelerate the development of inter-organisational services in the study site. On the basis of my findings, I acquired a thorough understanding of the strategies that are disadvantageous to the development process. In combining my findings with theory, I developed what I evaluate as justifiable suggestions on how regulatory authorities can handle the comprehensive and important domain that is electronic interaction-based healthcare.

7.1   Theoretical implications

One of the objectives of this study was to contribute to existing theories by identifying new knowledge and understanding of the chosen topic. In this section, I discuss the potential theoretical implications that can be extracted from this work.

7.1.1   Holistic theoretical perspective

In the previous chapters, I discussed how the development of inter-organisational electronic co-operation tools in Norway depends on close co-operation between system users and vendors. The climate for such co-operation is, however, challenged because neither the vendors nor the customers (the users) are willing to invest time and money in creating services. The paradox in this situation is that both the authorities and users in the healthcare sector welcome inter-organisational co-operation tools, with the authorities exerting efforts to invigorate the sector in a number of ways to speed up development. The measures that the authorities adopted are nonetheless strongly influenced by the political philosophies that are currently prevalent in Western countries. This study shows a strong link between a challenging development climate and prevalent political philosophies. To elucidate this link, I used of a number of theories and concepts that are considerably distinct from one another and do not belong to the same category under our education system. Information infrastructure is

situated in the layer between technology, sociology and organisational learning. Political philosophy and governance belong to social science. Data development and user interaction fall under technology science and organisational learning, respectively. The use of theories from different scientific domains enabled me to identify reasonable explanations to the laborious situation that characterises the development of inter-organisational electronic services for healthcare. The different theoretical perspectives complement one another. The study shows that studying development of electronic services implies much more than studying the completed product or studying the development process. One also needs to study issues like for instance contracting processes in order to understand the outcome. This approach implies that studies on information systems with some degree of public ownership must also examine the political issues that influence development. Studying this domain demands an inter-disciplinary approach because of the need to understand work practices, the implications of development and the complexities of information infrastructures, financing, project management, political governance and political philosophies.

7.2 Practical implications

7.2.1 ICT customer in healthcare – a difficult task

Health care practitioners lead busy and challenging professional lives that include illness prevention and diagnosis and the provision of care to patients. Their work depends on sound information systems because these enable them to document important information and co-operate with other practitioners. Studies have shown that the effectiveness of ICT systems that are intended to assist health workers strongly depend on fruitful input from the users of the systems (Johannessen and Ellingsen 2008; Ellingsen and Røed 2010). This perspective suitably fits into the basic neo-liberal idea that customers decide on which products are developed. This is also a philosophy that aligns with the concept of information infrastructures. What the current work particularly shows is that five main factors are responsible for the difficulties that health care institutions encounter in serving as influential customers in purchasing cooperative information systems. First, the health care institutions are diverse, with different owners that complicate coordinated order placement. Second, the development of collaborative ICT products frequently depends on two or more vendors who are also often competitors. Such a backdrop presents challenges in the collaboration amongst providers. Third, public procurement must adhere to regulations that are based on

competition. This regulation ensures that the public make purchases under the best possible conditions. The purchase of an ICT system is therefore based on transparency and should be publicly advertised. This compels the public to pre-define how a product should function because such specification guarantees that the public receive the desired products/services. Fourth, health care workers find pre-defining how collaborative ICT services should function a difficult task because envisioning the manner by which a service works in correspondence with existing information infrastructures is challenging. The fifth factor is that considerable financial risk arises from the development of inter-organisational services given the long period required for development and the reality of uncertain outcomes. Neither customers nor suppliers are willing to bear this risk.

These problems present difficulties to health care users in serving as influential and engaged customers when they purchase inter-organisational ICT services. Engaged users are not only important in the design process, but also influence the way new products achieve a foothold in the market. Such users can be persuaded to patronise a product/service when comprehensively understand how a new service accords with circumstances specific to their work practices. This goal must be achieved in a step-wise development process, wherein software is installed as soon as a minor component of a complete system is ready for demonstration. In so doing, users become co-constructors of the new system and a vendor can avoid creating functionalities that will never be used.

7.2.2   Third-party management

Research shows that information systems developed on the basis of a top-down approach underestimate the importance of involving users and have resulted in poorly adapted systems (Ellingsen and Monteiro 2003; Greenhalgh et al. 2013). Focus is recurringly directed towards the criticality of user participation in development. The current research shows that in the development of co-operational inter-organisations services, a new issue arises because no top-down management exists, and users are associated across different institutions. In such contexts, the balance of power amongst organisations influences development. The organisation that possesses the most power can advance its interests to an unreasonable degree. I discerned such unequal distribution of power in my research on ICT development in Norwegian healthcare. The main structure of Norway's healthcare sector comprises GPs,

hospitals and the municipal sector, with its home care providers and nursing homes. These three groups have different ownership structures:

(1) Approximately 4,000 GPs operate in Norway, and where most of them are self-employed and sole owners of the practice. These GPs are members of interest organisations that discuss all types of issues; in other words, no special focus is directed towards ICT.

(2) Nursing homes and home care providers are run by 429 municipalities. The municipalities established a forum wherein ICT-related issues are handled, but they have no specific health care group. The forum has guidelines on how the municipalities can establish formalised ICT co-operation. Even if several municipalities co-operate, hundreds of other municipals or multi-municipal units run ICT, and no formal co-operation for healthcare ICT exists.

(3) The hospital sector is organised in four regional health authorities and owned by the Ministry of Health and Care Services. It established a cooperative body designed to co-ordinate ICT-related issues in the hospital sector and between hospitals and other collaborators.

If these three divisions are to develop co-operational ICT services, skewed control conditions between the parties will occur. The hospital sector will be able to run development projects to a degree larger than that achieved by the two other groups. That the hospital sector is capable of establishing agenda is demonstrated in article three, which describes how the hospital plan to develop a service also includes functionalities for GPs and the municipal sector. This situation presents the risk that the GPs and municipalities will acquire an ICT service that is unsuited to their work practices. Note, however, that this problem does not originate from the top-down management approach of the authorities to development, but from a third party.

7.2.3   Electronic patient record – an obligatory passage point

In all my articles, a recurring point is that the EPR enjoys a dominant status in the healthcare sector. This view is echoed by several other researchers (Bowker et al. 1995; Szolovits 1995; Berg and Bowker 1997; Dick et al. 1997; Laerum et al. 2001), who highlight the EPR's function as a co-operational tool in an organisation (e.g. a hospital). EPRs contain an enormous amount of data, and the system is intertwined with existing work methods. *'Teasing this heterogeneous and seamless web apart, simply doesn't make much sense'* (Law

1994). The present research examined the challenges that arise when different organisations co-operate and reveals that co-operation-related information must be channelled through the EPR because co-operation mostly revolves around patient information and because health care workers want to direct information into their existing information systems. Under this approach, co-operation amongst health care organisations becomes highly dependent on EPRs not only in terms of functionality, but also in terms of vendor-related factors and to what degree a vendor is able to customise a product. The public healthcare information infrastructure, therefore, should not be viewed as a growing infrastructure, but as a structure on which limitations are strongly imposed during the development and connection of new services. This study shows that EPR vendors encounter challenging situations when they develop a functionality that is intended to function across institutions at different levels of the healthcare chain. These challenges are attributed to several factors. The specifications that the vendors receive from the projects have been difficult or impossible to understand. The vendors have repeatedly experienced modifications to specifications during development. The different projects that are initiated tend to escalate, overlap with one another other and increasingly become mutually interdependent. Another challenging task is co-operation with competing vendors. The extent of work involved in development is therefore difficult to predict by vendors and users and causes difficult order placement processes that a public purchaser needs to deal with. This complex vendor situation must be considered during the development of new electronic services for healthcare. I propose that breaking a complex service down to small manageable steps, will significantly reduce some of the problems discussed in this study.

7.2.4   Requirements in advance – unwanted in all respects

In the information infrastructure literature, a fundamental argument is that it is essential to build on existing infrastructures and apply a new product in real-world settings as soon as possible to attract actual users (Aanestad and Hanseth 2000). This strategy positions us close to the day-to-day practice of end-users, thereby enabling designers to effectively cope with the peculiarities of real-life settings (Suchman 2002). This study shows that years of requirement preparation was involved in the public projects underlain by the waterfall approach. Thus, a strategy that is driven by a step-by-step approach becomes difficult to implement when an introduced service is so complex that introduction to users entails a long time period.

This study shows also that in the ePrescription project, for example, the negotiation process gave rise to numerous functionality requirements because the entire service was described in advance and all potentially interesting functionalities were laid down during negotiation. This problem is attributed to the advance description of the service prompted by the perception that incorporating functionalities at a later date would be difficult. Such an approach may explain why only 20% of software features are frequently or always used and why 45% of such features are never used (Johnson 2002).

The insight that this study derived with regard to requirement preparation is that this process must be kept to a minimum; that is, it should revolve around the early introduction of new service components to users. This course of action enables users to contribute to shaping a service in a way that affords them opportunities for feedback within the extent allowed by the new functionality. This approach adheres to bottom-up development models, such as agile methods (Beck 2000), and has recently been introduced as an alternative to the waterfall method. These methods acknowledge that future needs are difficult to predict and that users cannot always specify what they actually need through the requirement specification process. This kind of strategy may result in re-designs of some system components but will simultaneously produce the functionalities that are most strongly needed by users. In the end, therefore, this strategy balances resource consumption.

7.2.5 Politically driven ICT-development in the healthcare sector

Considerable demand for co-operation in the healthcare sector has arisen, and a promising measure for satisfying this demand is to support inter-organisational co-operation with electronic services. Norwegian authorities support this reason and have accordingly exerted efforts in this regard for the two last decades. This study illustrates how the strategies of the authorities have changed, especially during the last 10 years. The previous strategy revolved around invigorating the sector through the funding of public projects that formulate specifications which vendors can use in developing new services. These types of funding cover expenses on public project groups but do not include expenditure for the end-users that pilot a new service and the vendors who develop the service. This strategy represents a philosophy that recognises customers as the ones who are most knowledgeable about their needs; when these needs are expressed, vendors strive to comply to expand their market share. Many projects were launched and specifications were created without software

development of new co-operational services, thereby resulting in considerable wastage of funding on failed or delayed projects. This study provides a composite picture of the situation that explains the difficulties that this strategy represents. First, health care users are caught in a very difficult situation when they order or specify a service in advance without close co-operation with vendors. Because of deficient results, the authorities have carried out new measures and have introduced a top-down approach by establishing considerable project organisation in the Directorate of Health, which operates several dedicated projects. These projects are of such a substantial scale that they require earmarked funding out of the state budget. This allocation means that projects are prioritised in a political process and not based on extensive deliberation in the healthcare sector. This study shows how the authorities have now become a significant stakeholder in Norwegian healthcare by acting both as legislator and project manager. They have also become customers in a highly dedicated ICT market and have affected the information systems that are the core ICT tools used by health care personnel. Additionally, this shift in roles has affected a vendor's position in the dedicated market.

The bottom-up and top-down approaches to governance and development have advantages and disadvantages, also discussed in this study. These benefits and drawback are well recognised, and middle positions, such as networked governance (Hartley 2005), have been introduced. In a networked governance approach, the world is regarded as unpredictable, constantly changing and complex. The role of governments '*is to steer action within complex social systems rather than control solely through hierarchy or market mechanisms*' (ibid.). This directive role requires co-operation amongst diverse and sovereign units that have no formal authority over one another. The role of public managers is to orchestrate the interests of different stakeholders. This approach focuses on overall design goals and plans; it also enables the development of individual applications in close collaboration with users on the basis of emerging demands. As this study demonstrates, institutions that adopt purely bottom-up or top-down approaches for large-scale projects on healthcare information systems will have to struggle to succeed.

On the basis of the results, I suggest that a middle position be adopted in organising large-scale projects on integrated information systems. I believe that in real-world settings, a step-by-step strategy is favourable but requires good conditions for continued growth. I argue that a project organisation resembling networked governance (Hartley 2005) and a development model resembling an organic model (Hartley 2005) are more appropriate than the currently

applied measures. These approaches acknowledge the variability of contexts, the fact that government bodies are only one of several equally important units in a network and the recommendation that a public body should be facilitative rather than authoritative and regulative in nature. Although a step-wise development process is advocated, it must also adhere to overall integration goals and plans. Critical tasks are to break down large projects into a series of smaller ones, prioritise direct business value and assemble stable, full-time and cross-functional teams that execute these projects along a disciplined agile and optimisation approach. Organisations that have adopted this approach have experienced major project improvements and increased project investments (The Standish Group 2013). In building a system, developers can start with a simple solution for a few user groups and then incorporate complex features and users in an evolutionary manner. This kind of strategy may result in re-designs of system components but will simultaneously produce the functionalities that are most strongly required by users. The overall advantage of this approach, therefore, is that it balances resource consumption. Under this approach, design issues can be shaped through a participatory process that involves actual users.

Funding has been a recurring theme in this study. I have pointed out that substantial monetary resources have been wasted because of extensive planning and administration that ultimately failed to produce valuable results. Additionally, I am unconvinced that huge projects, such as ePrescription, are effectively funded. A study in the US indicates that the US government allocates ICT project expenditures that are 10 times the cost of a similar project in the commercial sector (The Standish Group 2013). This is a significant difference that should be taken into account. I believe that the Norwegian government is willing to invest an unspecified amount of money in developing collaborative electronics for healthcare. The manner by which this money is used must be decided by users, so that services are developed on the basis of demand from the healthcare sector and not in accordance with a politician's interests. The development of information systems must be considered as work that is carried out by system developers and users and is therefore only marginally a consulting job that can be performed by a third party. That society rejects the idea of spending more time and money on negotiating a project than *implementing* the project is a reasonable stance. Given that Norwegian health care institutions operate within frames that are inspired by new public management, one can imagine why institutions are reluctant to participate in the development and testing of new services. An appropriate measure therefore is to fund testing to encourage the performance of such tasks in a fair manner. Functionality that depends on the EPR should

be adequately funded because the market mechanisms in the health sector are highly specialised and do not work similar to the mechanisms in a normal consumer market. Nevertheless, the entire community that provides health care has functional ICT systems.

7.3 Methodological implications

This research examined the development of electronic inter-organisational services in the healthcare sector, which is a domain with limited data access. I assume that this feature holds true in other countries as well. With such limited empirical subjects, I believe an essential task is to delve deeper into existing empirical subjects and the external factors that affect development progress. I was unable to find other research that focuses on the totality of a mechanism that affects development projects. For instance, I found no studies on the funding and market situation for vendors in my review of the literature.

Because this kind of study encompasses many academic disciplines, I believe that collaboration across research projects is crucial. Researchers need to scrutinise many factors such as project organisation, prioritisation mechanisms, contract placement, user involvement and regulations. Given the relatively minimal number of study objects, I believe an essential step is to conduct research across national borders to determine the positive results of service development. When I examine how money has been spent in ICT development for healthcare and consider the nearly negligible outcomes, I imagine that other countries also struggle with the same situation.

I believe that adhering to the processes of developing inter-organisational services is another critical aspect because frontline processes determine the final products or performance of systems. If we evaluate a system after it is implemented, we miss important information on why the system produced the outcomes that it did. Determining the effects of national strategies, the different ways of influencing ICT development in the healthcare sector and the results of implemented measures involves years of study. Therefore, research of this type should be longitudinal given the existence of gradually changing processes. Such an approach may enable researchers to discover a correlation between the way a process is carried out and the quality of results.

8 Conclusion

This study aimed to extend the knowledge on the processes that explain the slow development of inter-organisational electronic services in Norwegian healthcare. Combining the findings with theory enabled me to formulate justifiable suggestions on how the authorities can manage the comprehensive and important domain of electronic interaction-based healthcare.

A number of factors contribute to the difficulties that health care users encounter in serving as influential and engaged customers when purchasing inter-organisational ICT services. These difficulties, in turn, present challenges to the optimal functioning of market mechanisms. Engaged users are principal elements in the design process and influence the manner by which new products achieve a foothold in the market. Engaged users can be persuaded to adopt a service when they exhaustively understand how a new service functions in relation to their work practices. To this end, a necessary approach is step-wise development, in which software is installed as soon as a minor component of a complete system is ready for demonstration.

The fact that co-operation in healthcare mostly revolves around the exchange of patient information, a dependence on EPR vendors and the extent to which they can customise their products occurs. Inadequate requirements and lack of funding are problems that place EPR vendors in a challenging situation.

For the public projects that have been carried out, the actors normally prepared requirements in advance. In the ICT domain, this is not a recommended strategy because users cannot accomplish such task. The preparation of requirements must therefore be kept to a minimum, with actions limited to the introduction of the components of a new service to users at an early stage. This approach enables users to contribute to shaping a service in a setting where they can understand how the system will influence their daily work.

This study illustrates how the strategies adopted by the authorities have changed from being invigorating measures that are based on funding public projects to top-down approaches that establish considerable project organisation in the Directorate of Health. The recent strategy require earmarked funding out of the state budget—an approach that prioritises projects in a political process instead of basing such projects in extensive discussions in the healthcare sector.

The use of purely bottom-up and top-down approaches for large-scale projects on healthcare information systems will present serious obstacles to success. I therefore suggest the adoption of a middle position in organising such initiatives. I regard a step-by-step strategy as preferable in real-world settings, but this approach should be executed under good conditions for continued growth. In such an atmosphere, a public body should serve as a facilitator and not as an authority and regulator.

8.1 Further research

Expedient inter-organisational electronic communication in the public domain results in effective and reliable co-operation. Substantial amounts of public funding are infused into creating these solutions. Thus, a crucial endeavour is to evaluate the effects of new communication methods to determine whether these methods produce the expected advantages. This approach, however, provides limited knowledge because the shaping of such solutions begins at a much earlier stage. Therefore, another essential requirement is for researchers to study development processes from the very beginning and derive valuable information on why and how a service was shaped in a particular manner. This kind of knowledge is useful across disciplines and national borders.

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Article 5