Spring 6-10-2017

DISCURSIVE FORMATIONS AND SHIFTING STRATEGIES IN E-HEALTH PROGRAMMES

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Research paper

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Abstract

Research has shown that large IT programmes in e-government and e-health are challenging not only in terms of project failures and in terms of high costs, but also that the public and sectorial discourses greatly influences the trajectories and outcomes of mega-programmes. However, few IS studies have investigated this phenomenon in much depth, and the aim of this contribution is to shed more light on the relationship of discourse and mega-programmes. We use Foucault's discourse concept to analyse discursive formations aiming to promote and establish solutions in e-health programs, but frame our investigation in information infrastructure theory. Our empirical evidence is a 15-year study of the growth of the national e-health infrastructure in Nor-way, where we analyse the interplay of the national eHealth discourse and the various programme ini-tiatives. Our study offers two contributions. First, we demonstrate how the concept of discursive for-mation allows for an in-depth analysis of the role of discourse in large eHealth programs. Second, we show how shifts of discourse, combined with experienced problems in on-going programs, may disrupt the trajectories of large information infrastructures.

Keywords: Discourse, discursive formations, eHealth, Information infrastructures

1 Introduction

Our interest in this paper is to understand how large IT initiatives are being influenced and formed by discourses, and - reversely - how the discourses are affected by the practical experiences from these programmes.

Public sector IT mega-projects with political and societal prestige are usually initiated as a response to perceived problems, such as poor services or high costs. There are considerable risks related to this type of projects (Priemus et al 2008, Currie, 2014), both economical and organizational costs are high, and often these projects will attract considerable attention with possible negative publicity.

In a seminal article by Sauer and Willcocks (2007) *Unreasonable expectations – NHS IT, Greek choruses and the games institutions play around mega-programmes*, the authors describe the turbulent discourse of the failed NHS e-health programme. The main reasons for failure are that these structures are (i) much larger than single organization systems, (ii) technically more heterogeneous and (iii) organizationally more complex because of many stakeholders. Often, no single actor is in control, leading to long processes of power struggles, compromises and complex co-ordination. In addition, they are particularly exposed (as they should be) to public discourse, which Sauer and Willcocks analyse as three "Greek choruses"; the public officials who defend the programme, the internal institutions and medical professions that are "sympathetic critics" and the media, consultants and academics that constitute the "professional critics".

Research on discourse is associated to Foucault's archaeological research. The most cited contribution on the role of discourse in IS research is the *organizing vision* (Swanson and Ramiller 1997), which denotes how technology is viewed in the light of what it can do for organizations, how discourses about

technology is opening up further discourses about societal and organizational implications, and possibilities enabled through technological change.

Public mega-programs, however, are different from the private company context that Swanson and Ramiller researched, in the sense that the decisions are more complex, often involving hundreds of organisations, several technologies, public discourse and political pressures. One way to frame these issues is the *information infrastructure* research (Hanseth and Lyytinen, 2010), which has successfully investigated the nature and dynamics of large interconnected systems. According to this theory information infrastructures are not designed and implemented, but grow organically and adaptive from an open installed base.

Few studies have, however, dealt with the role of discourse. Therefore, we know less about the role of discourse in the evolution of public information infrastructures such as e-health. What are the more specific dynamics of discourse and large IT initiatives, for instance: how is discourse translated into action? What is the trajectory from political and public suggestions, ideas and choices to implementation? In short, how can we understand the dynamics of interaction between discourse and infrastructure when a program is encountering difficulties and alternative solutions emerge as problem solving? Our interest in this led us to ask the following research questions:

- What is the role of discourse in disruptive shifts in information infrastructures?
- Which patterns of interaction between discourse and infrastructure events can we identify?

In his work on scientific programmes and paradigms, Lakatos (1969) argued that "programmes" tend to continue in spite of experienced problems, as long as there are no clear alternatives present. This resonates well with documented management practices and the "garbage can" theory (Cohen, March and Olsen, 1972); when alternatives emerge, new decisions may be taken. We take this insight as our starting point, and analyse the interplay of discourse and reality of an e-health mega-programme, where we identify and analyse three strategy shifts. To develop our argument, we use Foucault's term discursive formation as our analytical lens, and we offer a model of discourse dynamics.

2 Information Infrastructures and Discourse

The literature on information infrastructures (Ciborra et al. 2000, Hanseth and Lyytinen 2010), describes them as open, heterogeneous, performative and emergent, and its central interest is patterns of growth. Examples of information infrastructures are the Internet, interconnected supply chains, financial systems, e-government solutions and e-health.

Infrastructures may grow in different ways, sometimes through decentralized autonomy (Ciborra 2000) i.e. through drift instead of control (Ciborra et al 2000), sometimes through centralized governance (Broadbent and Weill 1999). They can grow through bootstrapping, i.e. prototypes attracting a range of stakeholders and leading to a self-reinforcing or self-organizing installed base (Hanseth and Lyytinen 2010), or they can grow through enabling interaction between heavyweight and lightweight technologies (Bygstad 2016). Further, the information infrastructure research often focused on how inscription and translation is obtained. Inscription is about "the way technological artefacts embody patterns of use"; while translation is about shaping the infrastructure according to one's own needs (Monteiro 2000, 76, 77). In both cases, the infrastructure is seen as already existing, and the users either customize it to their own needs, or bend the use of it in a direction that suits them. The literature is much less clear when it comes to the role of discourse in infrastructural growth.

Earlier work using discourse analyses within the IS field has concentrated on the use of narratives and buzzword in management practices (Swanson 2002, Monod et al 2002, Westrup 2002); or on the relation between discourse and practice during implementation of technology or technological routines in organizations (Rose and Kræmmergaard 2002, Oliver and Oliver 2002, Gidlund 2015, Ellingsen and Monteiro 2008). A third group looks at how discourse is used as an existential tool downgrading the overwhelming amount of data and information in modern organizations (Wastell 2002, Edenius 2002).

The research on "organizing vision" (Swanson and Ramiller 1997, Ellingsen and Monteiro 2008) has given good insights into the role of discourse in technological strategies and implementation. They

show that the success of organizing visions depends on the flexibility enabled through the discourse, and how reciprocal transformations over time maintain the vision among the stakeholders. The ambiguity and flexibility is necessary then, for both the efficiency and the legitimation of the vision. This is necessary in order to mobilize participation in realization of the vision amongst the multitude of actors performing within the health sector. However, Swanson and Ramiller do not outline a distinct method for investigating the wider political implications of large programmes, but are more interested in the technology's role in the discourse. In addition, public mega-programs are different from the private company context that Swanson and Ramiller researched, in the sense that the decisions are more com-plex, involving hundreds of organisations, several technologies, public discourse and political pres-sures.

In our framing, *information infrastructure* is the existing socio-technical arrangements of digital artefacts and networks as well as the organizational rules and regulations which structures these arrangements. We use *discourse analysis* to identify and describe the existing as well as intervening challenges and solutions which seeks to improve or change the infrastructure in order to address an emergent shortcoming. The most important discourses emerges in groups or formations. We are inter-ested in the content of these formations and their relations to infrastructural change. In order to elabo-rate on this perspective we use Foucault's term *discursive formation*, in order to shed light on the rela-tionship between discourse and infrastructure evolution.

3 Discourse and Information Infrastructures

3.1 Discourses and discursive formations

The French philosopher and historian of ideas Michel Foucault's core of investigation is centred around the modern episteme which emerged in the early modern age, their patterns of growth and their content. His main point was that they emerged not only in the light of their own reason, but also as a result of gathering of discourses from several fields, both inside and outside the political and scientific institutions. His book "The archaeology of knowledge" from 1972 outlines his method for performing these investigations. In his historical research he investigates the emerging discourses, and identified something he called *discursive formations*. What is this?

In his archaeological research into history of thought Foucault tried to identify who said what, why this was said, what it meant, and what it led to. If a single person or a small organization stated something, the statement had little power. It was when a rising number of statements emerged that something became a discourse. Finally, when the discourse increased, the number of statements around a particular argument increased and maybe reached the books or in our days the media, discursive formations could be established. These discursive formations created through discourse their own "space of interplay" (Foucault 1972). This way of looking at the emergence of knowledge by investigating the role of the broader "popular" discourse, was radical, but not unreasonable.

Foucault was particularly interested in two aspects of the discourses. First he was occupied with how discourses was established through a statement's referentiality to a whole set of existing statements, utilities, practices and institutions (Schaanning 1996). We can see that this has to do with order, patterns or systems which establish themselves through practices, but also that it is something processual which is brought into play. The "space on interplay" (Foucault 1972, 204) opens up for emerging perspectives which doesn't necessarily subordinate itself to a single authoritarian logic (ibid).

In addition, a central issue is that the living conditions of the discourse are dependent on the object the discourse is connected to, and whether discursive formations agree on this object. "The object does not …pre-exist itself…It exists under the positive conditions of a complex group of relations" (Foucault 1972, 49). The object emerges under relational conditions and "juxtapose itself with other objects" (ibid, 50). This means that the discourse is defined by the external relations not by its own "nature", and that discursive relations establish the possibility for statements about a given object. The discourse is normalized through discursive formations that have the necessary power to institutionalize rules and regulations making them routine (Clegg 1998).

In order to understand the discursive formations, one has to individualize them in order to find how they relate on a deeper level. Things are not always as they seem, strategies may be the outcome of un-foreseen and not always "rational" alliances, and this is why it is necessary to analyze the actors and their programs individually. An historical investigation into shifting trends means that we have to un-pack the alliances in order to understand the individual parts, where they come from and how they are gradually established. What brought them together? What rules or patterns of interaction can be de-duced from the gradual formation of alliances?

The Archaeology, then, is the Foucauldian twist of using historical inquiries to inspect and examine, not physical objects, but the statements and discourses of the human sciences, "in order to uncover the discursive practices that constitute the field of knowledge" (Willcocks 2004, 250). Archaeology is the mapping of the enabling conditions for the production of truth and knowledge (Willcocks 2004) a "reordering of events…not perceived before" in order to lay bare the empirical conditions under which (expert) statements come to be counted as true (Hacking 1986).

3.2 The anatomy of discursive formations

Michel Foucault suggests four analytical strategies or ways or techniques to identify these gradually established chains of interactions named discursive formations. See Table 1.

First a discursive formation can be identified by its *area of interest*; what it is about, the object of its occupation. In Foucault's own work these entities are Madness, Sexuality or The Clinic, but the main point is that these objects are constituted by the virtue of the different discourses on the object. What is the central challenge that is addressed? What is it one is talking about within this area of challenge? The identification of the object is done through investigating the areas (surface of emergence and surface of appearances) where these challenges are talked about, and identify how and from whom the forming of the object is done (authorities of delimitation). This might be done by analysing and relating the different ways actors talk about the object to one another (grids of specification).

Second, the identification of enunciative modalities is about analysing the different actors. Who is speaking, with what right and qualification? From what institutional site, and with relation to which possible networks? The actor's utterance is of special importance if we understand the actors enunciative modality, that is, the mode of the actor, where, when, from whom and why the utterance is made. Foucault is particularly interested in the relation between the speaker and his or her position in relation to the actual debate.

The third way of identifying and defining discursive formations could be to inspect the formation of concepts – how concepts are established and used. This might be done through investigating the relation between concepts (types of dependence); by investigating their coexistence, or by looking at the procedures of intervention between concepts. Coexistence may be done by looking at how discourses travels between disciplines or by how old discourses is given new life. Intervention is how concepts from other fields are brought in and radically changing the way the object is understood.

	OBJECT	**ENUNCIATIVE MODALITIES**	**CONCEPTS**	**STRATEGIES**
Example:	Madness	Doctors, Judges, Experts	Older: genus, species Newer: Organism	Language conventions or economical discourse
Identified through investigating:	Where are the challenges addressed? Who is forming the object and how? How does the object of discourse relate?	Who is speaking, with what right and qualification? From what institutional site? What are the actor's possible networks?	Relations between concepts Coexistence between concepts Use of radical new concepts from other fields	Points of diffraction economy of the discursive constellations (why something lives on and something disappears) Decimation (who decides what strategies that count and why and what is the result)

Result:	Identification of the object of discourse	How the relations between discourse and actors are established	Concepts in the discourse and the "logics" of their relations	Understanding of contents and reasons for strategic shifts

Table 1: Elements in Discursive formations

Finally, the fourth way, the *formation of strategies*, is occupied with three different aspects. The first is about how the discourse is "spread" between fields. The second regards the "economy of the discursive constellations" which is about identifying the rules that leads to decimation of the discourse, why something lives on and something disappears. The third, decimation, is a part of a strategy to conserve social or scientific cultures. This is about who decides what strategies that count, why and what is the result of these decisions. In both cases however the main goal is to identify where the dis-course is coming from and the central rules for its unification. Table 1 gives a summary of the content of discursive formations.

3.3 The Role of Discourse in Shifts of Information Infrastructures

We have described the framework Foucault outlined for identifying discursive formations. Foucault was concerned with the contextual logic of the systems that challenged the existing programs. However, while discursive formations provide us with a lens to understand the anatomy of discourses, we need an additional theoretical framing. What makes shifts actually happen?

For Kuhn "normal science" was the step-by-step everyday work of scientists. Normal science was performed and elaborated until they were challenged by a new scientific paradigm that changed the whole area. Institutions, practices, intellectual and technological resources were lifted onto a new track (Kuhn 1996). Imre Lakatos was also concerned with the logic of system shifts, but he related them to the needs of the dominant programs had to (i) understand their own deficiencies, and (ii) open up to anyone on the outside who could complement the program (Lakatos 1970). This implies we use Laka-tos insight that "programmes" tend to continue in spite of experienced problems, as long as there are no clear alternatives present, and that disruptive shifts will only happen when discourse has identified and converged around an alternative strategy.

Summing-up, we are interested in the role of discourse in disruptive shifts of information infrastructures, and we suggested that Foucault's rich concept of discursive formations provide us with a powerful lens to investigate this. To understand why and when these shifts occur, we supplemented this with Lakatos' insight that shifts in programs will not take place until there is a viable alternative, brought to the scene by discourse. We investigated our case with this theoretical lens.

4 Case and Method

We chose a multilevel case study approach (Greenhalq et al., 2010) in order to investigate the inter-play of policies, programs and projects. Norway is a Scandinavian country with 5.2 million inhabitants who enjoy a high standard of living and public health services. The sector is governed by the Ministry of Health and Care, while the Directorate of Health is an implementing agency and health advisory. Primary care is supplied by private GPs and municipal services.

Our starting point was the national policies for e-health, which was a continuous public debate issue during these years (with links to the broader discourse on New Public Management), and presented some high-level IT governance and architecture issues. In order to identify the interactions of discourse and the growing e-health infrastructure our approach was to conduct a systematic analysis of (i) the documented discourses, (ii) the documented events and (iii) the interactions between them.

4.1 Data Collection

We studied the governance and development of a national e-health infrastructure in Norway over a period of fifteen years (2000-2015), at three levels:

- *The national level*: we interviewed top executives and IT managers at the Ministry of Health and Directorate of Health, analysed plans and initiatives, and we analysed the topics of the national e-health conference from 2001-15.
- *Regional level*: we investigated the development of a regional information infrastructure in the Health South-East from 2000 to 2015, through a sequence of programmes.
- *Project level*: we followed two large projects, the Portal project at Rikshospitalet in 2009 to 2011, and; the DIPS project at Oslo University Hospital 2013-2015. We also followed a smaller initiative, the Medicloud project in 2014-15.

In total, more than a hundred interviews lasting from between 1 and 4 hrs were conducted. We interviewed both strategic managers, project managers, IT directors as well as innovators and users. The notes taken during the interviews were transcribed directly afterwards, and shared amongst the researchers. Follow up interviews were taken when needed. In addition, more than fifty strategical documents as well as tender or competition proposals and documents or presentations from EHealth confer-ences was analysed. We also spent many hours observing meetings and seminars, and observing clini-cians use the various solutions.

4.2 Data Analysis

We conducted the following steps:

Step	Description	Output
1	Establishing a chronology 2000-2015, and identifying shifts in the discourse and infrastructure	Figure 1
2	Identifying and investigating the content of discursive formations	Section 5.2
3	Analysing patterns of interaction between discourse and infrastructure events	Section 5.2
4	Theorizing shift patterns	Section 6, Discussion

Table 2. Data analysis

In the first step, we conducted a temporal analysis of all our materials, identifying important events, both in the evolution of the e-health infrastructure, and the accompanying discourse. We identified three large *shifts* in the 15-year period. The result of this analysis is documented in Figure 1.

Then we identified three discursive formations, and analysed them in detail, using Foucault's framework, as described in the review section. In doing so we drew on our rich empirical materials, including a discourse analysis of the content of the annual national e-health conference. This relates to the Foucauldian strategy of identifying the object of discourse, and the actors gathering around the dis-course; their position as well as the "conceptual architecture" and the diffusion into a new strategy. Further, we analysed the shifts, i.e. patterns of interaction between discourse and infrastructure events that eventually led to disruptive shifts in the e-health strategy. Through this analyses we identified, not only the moments' relation between acknowledged shortcoming of the existing program, and the shift; we did also carefully analyse the content of the different trends thereby giving a deeper understanding of the content of discursive formations. Finally, drawing on Lakatos, we proposed answers to our re-searched questions, and theorized the shifts, connecting more explicitly with information infrastructure research.

5 Findings and Analyses

We first give an overview of the growth of a national and regional e-health infrastructure the past 15 years, and the on-going discourse, in order to establish a chronological baseline. Then we analyse in more detail the interactions between the discourse and the events.

5.1 Background: Growth of national and regional e-health infrastructures 2001-15

Until 2002 all public hospitals were owned by the 19 Norwegian counties. 1st of January 2002, the central government took over the ownership and organized the hospitals in five health corporations called Regional Health Authorities (RHA) given the names Health North, Mid, West South and East respectively. In 2007 South and East were merged into the South East Regional Health Authority ("Health South-East"). In total there are currently 39 legal public hospitals organizations, each of consisting of up to 10 individual hospitals.

Before the reform in 2002, ICT strategies and decisions were attached to the individual hospital. The motivation behind the reform was a commonly felt need for more and better coordination and collaboration among the hospitals. Moreover, it was a broad consensus about the importance of exchange of information electronically for achieving this. So immediately after the reform, each region established a central organization representing the regional health authorities and an ICT unit as a part of this. In all regions, it was decided to focus on standardizing ICT. The most important was to standardize the most important applications, i.e. that all hospitals should run the same EPR, radiology, lab and chart and medication systems etc. All regions also established a governance model based on Gartner's so-called Y-model[1] which organize the overall ICT activities and responsibilities into three roles control and strategizing (regional board and management), customer (hospital) and vendor (regional ICT vendor). All regions transferred most of the ITC staff in the hospitals into a regional ICT organization. The strategy for standardizing applications was based on tendering processes where the regional au-thority signs a "framework contract" with one vendor for each application running for 5-10 years. The hospitals decide on their own when they need a new solution, but compliant with the contracts. In 2003 an organization called "*National* ICT" was established on the Ministry of Health's initiative in order to achieve better coordination of ICT activities and solutions among the RHAs. Specifying a common ICT architecture for all regions based on a service-oriented architecture, and standardizing archetypes for core data elements have been among the highest prioritized activities.

In spite of these and other initiatives, the overall ICT portfolio within the hospital sector has remained fragmented and information exchange between applications and organizations problematic. Around 2005 the fragmented eHealth solutions were brought to the attention of national media, through histories of poor patient treatment because of non-integrated IT solutions, and ridiculed the practice of transporting x-ray images by taxi between hospitals. The political pressure on the sector increased, and the answer from the top health executives to the challenge was to establish a new governance regime. One reason for this disappointing situation is the fact that while some applications where standardized within the regions, new ones were continuously introduced to support various new specialist practices, as a part of new digital instruments, etc. And while an increasing number of hospi-tals were running the same software packages, these packages were configured differently among the hospital making information exchange almost as difficult as if they were using applications from dif-ferent vendors.

[1]Helsedirektoratet (2014). Utredning av «én innbygger – én journal» Komparativ analyse av de regionale helseforetakene på IKT-området. September 2014. https://www.regjeringen.no/contentassets/355890dd2872413b838066702dcdad88/komparativ_analyse_rhf_ikt.pdf

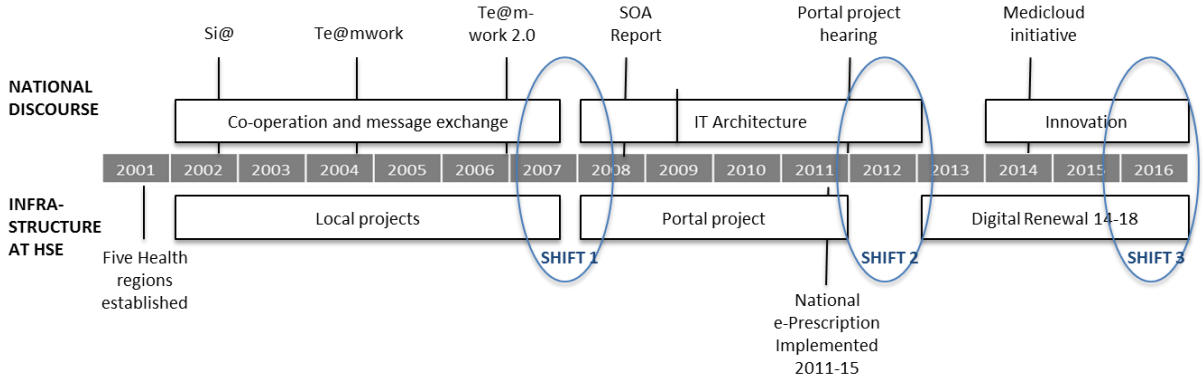

Figure 1. Timeline

5.2 Patterns of interaction and shifts

Figure 1 show three phases of discourse and three phases of programmes. The discourses were held at a national level, while we analyse the programmes that were conducted within the largest (South-East) health region. We identified three large *shifts* in the 15-year period. A shift is here understood as a significant change in both discourse and actual programs. The shifts are illustrated in the timeline.

We identified three different national discursive formations aiming at providing solutions to the acknowledge challenge in the e-health program; growing an integrated infrastructure. The discursive formations were conceived from of a common discourse on modernization of technological health infrastructures, but differ in the way they position themselves within those discourses.

We will analyse the findings in four sections separated by the three shifts. The theoretical lens gives us a vocabulary to understand the discursive formations and their content that gives them power to enable change. We will also discuss them in relation to each other, identifying the scale of change by looking at the regularity. See Table 3.

DISCURSIVE FORMATION	SHORT-COMING	OBJECT	ENUNCITIVE MODALITIES	CONCEPTS	STRATEGIES
Co-operation and message exchange	Paper-based records and lack of cooperation	Digitalization	National, regional and local authorities. Gartner group.	Cooperation	Centralized Strategy, Decentralized Autonomy, Combination top-down and bottom-up
IT Architecture 1	Slow progress, fragmentation	Fragmentation	National authorities, International agencies, and consultants	Modularization	Modular architecture, Top-down Governance
IT Architecture 2	Collapse of Portal project	Consolidation	National authorities and politicians. Norwegian parliament. The control committee	Integration	Integrated architecture, Top-down Governance
Innovation	Lack of innovation and decentralized autonomy	Flexibility	National and international agencies, local hospitals. Commodity suppliers	Innovation	Cloud-based Architecture Agile strategies Mixed governance

Table 3. Discursive formations analysis

5.2.1 Cooperation and message exchange

We call the first discursive formation we identified "Co-operation and message exchange", and it first addresses the challenge of paper-based records. The most important object of the government takeover of the hospitals was the need for standardization through *digitalization* of the central application core: The medical records, the lab solutions, and the pacs systems. The increased possibility to obtain *digitalization* had been an important issue of all the political and technological debates on Health-IT evolution for several years. The strategic report "Health for every Bit" from 1997 emphasized digitalization, and Gartners Y-model was seen as a strategic tool to facilitate the diffusion of this strategy.

Historically each hospital, and even each department, had been working on digitalization acquiring or developing their own IT systems, reflecting functional specialization. In addition to shared systems, such as patient record, chart and medication, lab, and imaging, most units had acquired their own systems for births, cancer, diabetes and so on. In the period 2001-2007 most hospitals in the country conducted their own projects, many of them addressing the increasing need for integration of various "silo" solutions. The strategy was intended to facilitate centralized standardization, but it lead to more fragmentation. Why?

After the establishing of the five health regions in 2001, there was an on-going debate on *co-operation* at many levels. The political inspirations are observable in strategic reports like "Say@" from 2001 and "Te@mwork" from 2004. Inside each hospital it was increasingly acknowledged that clinicians needed access to medical information produced by other units; likewise, inside each region there was a need to exchange data, particularly between hospitals and primary care GPs. Finally, at a national level, there was a need to exchange patient information between regions. How should this be done, given the variety of solutions? The answer, according to the Directorate of Health, was to exchange standardized messages, and a long-lasting campaign, *Message Exchange*, run for several years.

We can thus say that the first of the four periods are conditioned by discourse on the object of *digitalization* – the move from paper to digital medical records – through the concept of *cooperation* - the enabling of cross-units' interaction. The discursive formations are important drivers for system change, but also for the level of scale the change causes. In the first period after the change of authority from the counties and the university hospitals to the State, there was still a significant power in the decentralized model, and the state had to take this into account by enabling local freedom. This lead to a decentralized governing model with distributed freedom for local projects to build on their installed bases, using messages based on standards which were agreed upon, to communicate between health units. Even though the object of discourse – digitalization - is the central goal, the combination of centralized strategy and decentralized autonomy gives the ambivalent result of enforcing other aspects, like the concept of cooperation.

Progress was slow, and both the internal and national discourse started to show signs of impatience. We interviewed a key player in policy development, and asked for his assessment of the current situa-tion and the road ahead. He commented:

> "The main problem is the fragmentation of solutions, which has a historical explanation. Each hospi-tal, each clinic – and even each clinician – has had the freedom to choose any solution that was available, during that past 30 years. These choices have often been made arbitrarily, dependent on which vendors were knocking on the door, or other local conditions. The result is hundreds of different solutions, which cannot exchange data, because of the lack of standards, and cannot communicate, because of the lack of integration. Today, this is a hindrance for patient oriented care, and for evidence based medicine. It is also expensive. There is only one solution, which is an overall consolidation to shared systems, and a standardization of data and processes. This requires the courage to establish a top-down governance, an integrated architecture and well-financed programmes to implement the strategy".

The message exchange initiative inherited the decentralized structure from the preceding programs. The more profound problem of fragmentation was not sufficiently dealt with, and the increasing tendencies of centralization lead to a shift in the discourse.

5.2.2 Shift 1: From message-based cooperation to SOA

Programs continue despite failures until new solutions are provided. The slow progress and fragmentation of the message exchange initiatives led the authorities to tighten the control and look for a standardized model which could solve their problems. The discursive formation of IT architecture emerges, and with it the strong concept of modularization. Several architectural solutions were suggested. Once they found the SOA (Service oriented architecture), they thought they had found the remedy. SOA had been introduced in the software engineering community in the early 2000s (Erl 2009). In 2004, the national e-health group "National ICT" initiated a project for a National IT-Architecture, resulting in a large report in 2008, which recommended a completely new approach for e-health solutions, based on SOA. The aims were quite ambitious, and emphasized patient-centred care, a process perspective (instead of IT silos) and role-based services. A national architecture based on a shared information model and service bus technology was recommended.

In line with these principles, a possible pilot was available. At the most prestigious national hospital (Rikshospitalet) the IT department had developed a portal solution, based on SOA. The portal solution was built on the idea of a new layer over the silo applications that gave clinicians role-based access to various services. The solution required some re-engineering of the applications, from GUIs to services, and also dealing with a complex set of security and privacy issues.

Rikshospitalet, SOA, Gartner, National ICT were not the only actors for-fronting this strategy. The discourse on architecture gradually resulted in an internationalization of the scope, bringing foreign suppliers into the setting. A tender for a full solution was won by a New Zealand software company in 2010, and expectations were high, both in the local and national e-health communities. However, the company was not very experienced in e-health solutions, and large problems emerged during implementation.

We can see that the problem of fragmentation and slow progress leads to a discourse on IT architecture and modularization. Modularization presupposes not only a central organization of architectural decisions, but also a very mature service layer where components are related through loose coupling. The discursive formation of IT architecture thus brings with it a stronger focus on centralization and top-down governance, and a modularized solution. After one year of intensive preparations and works, the project collapsed. Why?

The change can be understood by its radical strategic shift of modular architecture. But how can the object of the discourse – fragmentation – be solved by modular architecture, instead of the more con-tiguous solution of integrated architecture? Modularity seemed as a solution by providing both top-down government as well as decentralized distribution of authority. The radical transformation is that this is difficult when the premises for modularization is not present, that is, the pre given conditions was more located in the strategies than in the reality. This lead to the second shift.

5.2.3 Shift 2: From SOA to integration

Changes are not always voluntarily, and in 2011 the Portal project was stopped after having spent around 20 million Euros. The event became a national scandal in the media, and an inquiry was conducted at the Norwegian Parliament where the leader of the Control- and Constitution Committee claimed that the project suffered mismanagement of highest order. One result of the negative press was that the term *portal* was scandalized. The e-health community embarked on a discourse on *best-of breed* (choosing different applications, and integrating them later) of *suite strategy* (choosing one, integrated solution, such as EPIC). There was now an urgent need for a new solution. The discursive for-mation of IT architecture remains, but changes first to hybrid architecture, which later turns into inte-grated architecture.

The solution consisted of choosing the EPR solution most widely used in Norway (DIPS) as the central application, and to integrate it with other systems with a service bus middleware, and "bundle" this strategy into a large architectural program called *Digital Renewal.* The program was given around 1 bn. Euro, and was initiated to standardise and implement this architecture for the 70 hospitals in the region. A separate unit, the Integration Factory (specializing on Microsoft BizTalk) (Bygstad 2016, Bygstad and Hanseth 2016), was established to program the numerous physical integrations between

the central EPR and the other clinical and administrative systems. The key project, implementing DIPS with the needed integrations, ran successfully in 2013-14. The other health regions, with one ex-ception, ran similar projects. The discourse on e-health architecture continued in the sector, but on a more sober tone; the SOA ideal models were largely put to rest, and the discussion centred on *suite* or *best-of-breed* solutions, actualised by the Copenhagen and Helsinki health authorities' decisions to ac-quire EPIC.

Even if the portal project collapses, the discursive formation of IT architecture and top-down governance remains, but shifts to a focus on consolidation. There is then continuity in discourse on IT architecture and centralization, but a change in strategy from modular to integrated architecture and sys-tems. The regional authorities reshuffled their strategies into a more realistic approach were Consoli-dation became the central concept. The fragmentation was addressed by an orderly "bottom-up" ap-proach taking the existing 4000 systems into account, but by "cleaning up the mess", removing some of them, rationalize some of them and integrate the rest.

5.2.4 Shift 3: From integration to innovation

A new discourse was entering the field in 2014, when it became clear that although Digital Renewal approach was successful, it was quite expensive, and it provided few new services, since most of the resources went to integration and consolidation. Many clinicians worried that all other IT initiatives were stopped for the lack of money, which was considered very unfortunate, because of a stream of innovations in the medical field, based on lightweight IT such as sensors, tablets and mobile technology. In addition, upstart companies complained that the heavyweight IT communities blocked access to innovations (Bygstad, 2016). This echoed an international discourse in e-health, where a *platform* strategy (Baldwin and Woodard 2008), with ecologies with large vendors and third party innovators, was becoming popular. For instance, Epic and Apple signed a co-operation agreement in 2014.

Because of the increasing discourse on innovation, HSØ established a new unit, *Medicloud*, with a mandate to explore possible solutions to connect heavyweight and lightweight IT. Medicloud, which was part of the IT Service Centre (HospitalPartner), quickly established relationships with various clinicians and upstart IT companies, and in 2015 a number of pilot projects were initiated (Øvrelid and Bygstad 2016). At the annual e-health conference, the shift in discourse was evident. Medicloud held a separate event to accommodate lightweight innovations, and the large EPR vendors assured the public that they were quite open to offer APIs to app providers.

The clinical part of the "digital renewal" program had three main goals: reduce the amount of systems; standardize remaining systems; enable integration between them through standardized messages. This orderly approach to "clean up the mess" became very expensive and very slow, and lacked inno-vation. Innovation may however challenge the existing regime. Innovation may be driven with what Bygstad (2016) calls "lightweight IT" knowledge regime which is in contrast to "Heavyweight IT" re-gime. Even though the huge project of Digital Renewal admits shortcomings and opens up for innova-tion, it is still not clear how to do it and at what cost.

The new discursive formation of innovation supported and strengthened by national and international agencies, local hospitals as well as suppliers of commodity software gathered around the object of increased flexibility through strategies of cloud-based architecture and mixed governance. The discursive formation of Innovation is thus a heterogeneous undertaking that relates to both making new products, speed up the production process as well as enabling decentralised autonomy, and there are several challenges related to how to embed it into the program. The balance between order and innovation needs to be worked out, and this is in itself a sort of transformation between existing and pre-existing paradigms of both software development and program governance.

6 Discussion

In this section, we return to our research questions. Our general contribution is that we extend infor-mation infrastructure theory by including discourse as a key factor in infrastructure evolution.

We are interested in the relationship between existing infrastructure, the emergent discourses that arises when weaknesses are identified in the existing infrastructure, and how these emergent discourses influence and change the infrastructures. Within the frame of this contribution we add to the existing literature on the role of discourse in IS in our two contributions:

- We propose an analytical framework for discourse analysis
- We use the framework to analyse the dynamics of discourse and infrastructure in strategy shifts in national e-health programmes

We used an analytical framework when analysing our data, and identified a repeating pattern of interaction of discourse and growing infrastructure. The analytical framework is an adaption of Foucault's archaeological method for identifying discursive formations, appropriated to the IS context. As Foucault is mainly interested in the content of discursive formations rather than the cause of the change from one formation to another, we have added Lakatos' insight that program shifts are caused by shortcomings or failure in the existing program. Unpacking strategic shifts understanding the object, modalities, concepts and strategies give insight into the anatomy of discursive formations presenting themselves as solutions to the acknowledged shortcoming or failure. The content of discursive formations; the object, modalities, concepts and strategies may have varying strength and impact. The insight into the different elements in the formations and their content thus enables us to gain deep knowledge on the role of discursive formations in Infrastructure evolution, as well as their varying strengths.

Our second contribution follows from the insight given by our framework. Strategic shifts are explained by the dynamic interaction between infrastructural programs and technology discourse. The discourse is conditioned by actors positioning themselves in the struggle for power of definition through defining the object, concept or strategies. Technology discourse is broad enough to make sense also for managers, strategists and politicians creating a powerful coalition providing solutions to common problems. The shifts may address challenges of varying difficulties. While challenges of minor or medium difficulty may be solved by choosing existing available options; challenges of high difficulty may require an entirely new conceptualization of the whole strategic approach. As an example there is a difference between the relatively drastic shift from local projects with decentralized authority, to a portal solution which requires an entirely new IT architectural foundation (Shift 1); and a continuation of IT architecture shifting from modularization to consolidation (shift 2). There is also a difference in the challenges related to Shift 2 and Shift 3, in that Shift 2 is a continuation while Shift 3 challenges the whole regime, introducing new challenges to governance. This detailed insight may be further investigated using the same framework. Nevertheless, the same basic rule applies to all of them: The proposed solution to an acknowledged shortcoming has to be strong enough to convince the existing programme management (politicians or strategists) that it will fit their purpose.

Generally, we contribute to information infrastructure theory (Hanseth and Lyytinen, 2010), which has not dealt much with discourses, with the exception of Ellingen and Monteiro (2008). This stream of research has emphasised that infrastructures evolve as a growth of an open installed base, adapting to changes in the environment. Our position is that discursive formations should be included in the installed base, and often play an important role in this evolution. In particular, as our case vividly illustrates, discourse plays a key role in strategy shifts. While Ellingsen and Monteiro highlighted the flexi-ble character of organising visions (allowing actors with different interests to converge), our findings document a more detailed trajectory of the cyclical nature between infrastructure and discourses.

7 Conclusions

In this study, we investigated the discourse dynamics in large e-health initiatives, through a longitu-dinal case study. We offer three new insights. First, we propose an analytical framework for investi-gating the role of discourse in infrastructural evolution. Then we use this framework to explain the shifts of the infrastructural programs and the reason for this. In general, we extend information infra-structure theory by including the discourse term into the installed base. The study was exploratory, and further research should validate our model.

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