

ESTABLISHING SPACES OF INTERPLAY: THE ROLE OF DISCOURSE IN THE GROWTH OF INFORMATION INFRASTRUCTURES

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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 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 build loosely on Foucault's discourse concept and on Swanson's term of organising vision, 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 Norway, which we investigate at three levels, where we analyse the interplay of the eHealth discourse and the various programme initiatives. First we identify the system formations that bring about change as well as analysing their content. Then we identify and discuss a pattern where windows of opportunity open and narrow in waves of discourse and action. We also contribute to the information infrastructure research by highlighting the role of discourse in infrastructure evolution.

KEYWORDS

Discourse, discursive formations, eHealth, infrastructure

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 a response to perceived problems, such as poor services or high costs. There is often considerable risks related to this type of projects (Sauer and Willcocks 2007, Currie, 2014), both economical and organizational costs are high, and often these projects will attract considerable attention with

negative publicity as a possible result. Sauer and Willcocks (2007) describe the turbulent discourse of the failed NHS e-health programme. The main reasons are that these structures are (i) much larger than single organization systems, (ii) technically more heterogeneous and (iii) organizationally more complex because of many actors. 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 (1972). The most cited contribution on the role of discourse in IS research is the *organizing vision* (Swanson and Ramiller 1997), which is about 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, 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. What we know less about is 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? How is discourse translated into action? What is the trajectory from political suggestions, ideas and choices to implementation? Our research questions are:

- Which patterns of interaction between discourse and infrastructure events can we identify?
- How do managers deal with these trajectories and situations?

In his work on scientific programmes and paradigms Lakatos (1970) 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 the discourse will change. With this insight we analyse the interplay of discourse and infrastructure of e-health mega-programmes, identify and analyse three strategy shifts. To develop our argument, we use Foucault’s term *discursive formation*, and we offer a simple, yet powerful model of discourse dynamics.

2. INFORMATION INFRASTRUCTURES AND DISCOURSE

The term information infrastructures were introduced in the 1990s first as a program of political strategy through Al Gores term “information superhighway” and the so called “Bangemann report” on Europe and the global information society to the European council in 1994. Later, information infrastructures became a more specific concept within IS research. A

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main source of inspiration for IS research on infrastructures was Thomas Hughes “Networks of power” and “The evolution of large technological systems” focusing on major engineering systems, analyzed as socio-technical systems. The field of infrastructures helped to change the perspective of systems to networks and of tools to infrastructures, which opened up a global and emerging perspective on IS (Bygstad 2008). The literature on Information infrastructures (Ciborra et al. 2000, Hanseth and Lyytinen 2010), thus, describes IIs as open, heterogeneous, performative and emergent, and its central interest is patterns of growth.

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). It can grow through bootstrapping, i.e. utility based prototypes attracting a range of stakeholders and leading to a self-reinforcing or self-organizing installed base (Hanseth and Lyytinen 2010), or it can grow through enabling interaction between heavyweight and lightweight technologies (Bygstad 2016). A lot of research has been done investigating this growth, but the literature is much less clear when it comes to the role of discourse in infrastructural growth.

Secondly, the literature on II often focuses 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 user either customizes it to their own needs, or bends the use of it in a direction which suits them. The discourses role in establishing spaces of interplay through performative acts of discussions, negotiations and translation, is compatible with Information infrastructures. In addition, it extends the understanding of information infrastructure implementation and evolution in that they focus on debates preceding the implementation of the actual infrastructures.

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).

We will use discursive formations to analyse the formation of technological trends within big public sector programs, discursive formations are gathered around organizing visions of the technology’s ability to solve a particular problem. Shifts occur when some understood shortcoming in the program, and when an alternative exists, or when the program fails and alternatives are established through the shift of discursive formations from one program to another. The concept of discursive formations, formations obtained through performative acts of discussions, negotiations and translation, is compatible with Information infrastructures. In addition, it extends the understanding of information infrastructure implementation and evolution in that they focus on debates preceding the implementation of the actual infrastructures, as well as adding to the understanding of how infrastructures open and close.

3. DISCOURSE AND REALITY

3.1 Discourses and discursive formations

Discourse may be simply defined as “talk and texts as parts of social practice” (Potter 2004, p.105). In a practical sense discourse is a shared and fundamental everyday phenomenon. As humans we live our private and professional lives in rhythms of action and discourse; we discuss what to do, then we act, and afterwards we discuss the results of the action, and what to do next.

The French historian Michel Foucault's main interest was 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 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's point of departure was that “grand narratives” was not issued from a position which removed all opposition, but that alternative narrative, speculations and suggestions opened up alternative discourses which could condition the scientific (or technological in our case) programs. The “space of interplay” opened up for emerging perspectives which didn't necessarily subordinate itself to a single authoritarian logic (ibid). The development of statements in a common field of discourse attracted and drew on constellations, institutions, and concepts in order to gain power. Discourse is an integrated part of the modern political, organizational and scientific knowledge communities and thus an important element in what we have to understand in order to understand change within organizations.

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). Discourses are thus not only about texts and talk; the relations characterize “discourse itself as a practice” (Foucault 1972, 51). To analyze discourses then is about practices that systematically form the object of which they speak; the

discourse and the object of discourse is gradually gaining momentum and power through the interaction with each other. The discursive power obtained through discursive formations is the gathering of a whole range of stakeholders within a common field of objects, a field of association. In analysing technological discourse, then, we must look at the whole network of statement, discourses, analyse discursive formations and the formation of objects, that is, the way the resources are mobilized by providing statements which activates institutions, practices, features in order to make right. In this we can see that discourse and materiality interact and create a fundament for solutions to a challenge.

3.2 Organizing Visions and Space of Possibilities

The “Organizing vision” (Swanson and Ramiller 1997) is basically about how technology is viewed in the light of what it can do for organizations, that is, how discourses about technology is opening up further discourses about societal and organizational implications and possibilities enabled through technological change. Discourses about technological and organizational development is a response to a particular problem (ibid, 462). The enabling of organizational change through technology exists because there is a “collection of actors which agrees in that it exists” (ibid), that is, the “establishment and maintenance of the discourse is...negotiated within the community...”.(ibid). This however needs some elaboration.

The mega-projects consisting of coalitions of systems, joint practices, standards, technologies, which one tries to unify against a common purpose, a common use, is necessarily extensive. This also means that there is a need of clarification on how the practical value will have to be obtained, there is an advancement from organizing vision to organization and practical value (ibid, 463). This happens according to Swanson and Ramiller through three phases, interpretation, legitimation, mobilization. In addition, the process is going along two separate trajectories. One of them is regarding how the organization needs to improve, and what has to be done in order to obtain this. The second is what type of technology is needed in order to enable organizational change.

Ellingsen and Monteiro (2008) investigate how 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. As an example, the health system is both a production unity with a lot of equipment, and a complex logistical organization of the access and use of this equipment. The health system is however also an institution with a lot of beliefs, rules and ideas linked to profound clinical knowledge. In identifying needs and a solution to those needs the “material resource environments are influenced by the institutional context (Currie and Guah 2007). The agreement on how technology can be used in this type of organizational diversity is advancement from the mere “vision” on technology’s possible usability.

Mega-projects thus bring with it a coalition of knowledge areas, security issues, management issues, clinical issues etc., and the technology’s initial state where “some parties seek to command the organizing vision, while others trade on its interpretive flexibility” (Swanson and Ramillier, 464) has thus evolved to become a positioning between separate and potentially “competing” institutional logics which may collide. (Currie and Guah 2007) “Large-scale change programs require participants not only to do things differently, (but) to do different things.” (ibid 241) They have to align themselves in order to make technological

acquisition and organizational improvement possible. This also mean that the different knowledge areas may organize and ally themselves with different “user groups and industry associations to achieve greater political and economic voice” (Swanson and Ramillier 1997, 464). When one solution does not fit all, there will be an “application gap”, which also makes new technology an important driver (ibid, 467). This way from organizing vision to organizational complexity in first securing “local” requirements and then seek to obtain alignment, is part of the “continuous shaping and reshaping as the material processes of innovation adoption, implementation and diffusion play out over time” (ibid, 468).

In big projects in the public sector it is expected that strategies and plans is sent around to foras, management and users which is affected by them, so that they can give feedback, input and critique. There is a need to establish a broad agreement. Sometimes important decisions are taken outside these foras, and projected onto the programmes, sometimes in a hurry, sometimes randomly under high pressure, and sometimes based on informal positioning gained through specific types of contemporary technological or organizational ideas and trends which are “hot” for a shorter or longer time.

4. CASE AND METHOD

We chose a multilevel case study approach (Greenhalq et al., 2010) in order to investigate the interplay 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, and also presented some high-level IT governance and architecture issues. In order to identify the interactions of discourse and materiality 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 South-Eastern Regional Health Authority 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.

4.2 Data Analysis

We conducted the following steps:

Table 1. Data analyses

Step	Description	Output
1	Establishing a chronology 2000-2015	Figure 1
2	Conducting a discourse analysis	Table 2
3	Identifying patterns of interaction between discourse and infrastructure events	Table 3
4	Assessing patterns	Section 7

The multilevel systematization was performed through analyses of interviews and documents as well as a systematic review of the national health IT conference, through four stages:

The data was collected over 15 years both from national conferences, national strategy documents, interviews with managers, collected and registered into a common matrix. We analysed the data chronologically and found three discursive formations. They are shown in the upper part of figure 1. We then looked for relations between the discourse in political and strategical documents, in other documents as well as from the interviews, and the actual implementation of the infrastructure. We did this by systematizing the matrix in 4 categories: The dominating program, the acknowledged shortcoming which the dominating program addressed; the common vision which led to the program and the common object. The acknowledged shortcoming and the common vision relates to Swanson and Ramillers theory of organizing visions addressing a “application gap”, while the common object is inspired by Foucaults “space of interplay” where actors gathers around discourses on technological trends.

Through the analyses we first identified when the discourse was turned into something particular, that is, we identified the moments when the solution was established and maintained. Finally, we identified when the strategy encountered problem, as well as the emerging strategies for providing remedies to these challenges. Table 2 describes the findings of this part. In the fourth step we identified – based on the result of the analyses – the relation between the discourse and the shifts from one infrastructure solution to another. This relates to Lakatos’ (1970) idea of problem solving: when experiencing a problem within a “programme” work tends to go on, unless there is a clear alternative presented. The outcome of the analysis in point 3 and 4 are thus figure 1, table 2 and 3. In section 7 we discuss the implications of our investigation. We will now describe in more detail these findings.

5. FINDINGS: INTERACTIONS

We first give an overview of the growth of a national and regional 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 Growth of e-Health Infrastructures in Norway 2001-15

Until 2002 all public hospitals were owned by the 19 Norwegian counties. In 2002, the State 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.

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 better coordination and collaboration among the hospitals. And 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, especially the most important applications, so that all hospitals run the same EPR, PACS, Lab solution etc. All regions also established a governance model based on Gartner's so-called Y-model which organizes the overall ICT activities and responsibilities into three roles: control and strategizing (RHF board and management), customer /ordering (hospital) and vendor (regional ICT vendor). All regions transferred most of the ITC staff in the hospitals into a regional organization. The strategy for standardizing applications was based on tendering processes where the RHAs sign a "framework contract" with one vendor for each application running for 5-10years. The hospitals decide when they need a new solution. Then they have to buy the solution from the vendor with which the RHA has signed the "framework contract." 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 the SOA model and standardising 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 were 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 hospitals 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 different vendors.

5.2 Patterns of Interaction

The timeline of discourses and growth of the infrastructure is illustrated in Figure 1. It shows, broadly, 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

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(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 Table 2.

Historically, each hospital, and even each department, had acquired or developed their own IT systems, reflecting functional specialisation: 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, and 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 discourse during this period included several topics, but after the establishing of the five health regions in 2001, there was an on-going debate on *co-operation* at many levels. 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, the *Message Boost Initiative*, was run for several years.

Progress however 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 situation and the road ahead. He commented:

“The main problem is the fragmentation of solutions, which has a historical explanation. Each hospital, 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 top-down governance, an integrated architecture and well-financed programmes to implement the strategy.”

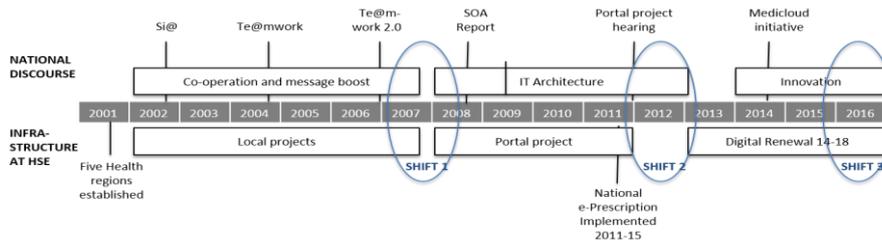


Figure 1. Timeline

5.2.1 Shift 1: From Message-Based Cooperation to SOA

The shift was triggered by the combination of slow progress of the many local projects and the arrival of an alternative, namely service oriented architecture (SOA). SOA had been introduced in the software engineering community in the early 2000s (Erl 2009). In 2004 the national e-health group initiated a project for a national IT architecture, resulting in a large report in 2008. The report recommended a completely new SOA approach for e-health

solutions. 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 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. 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.

5.2.2 Shift 2: From SOA to Integration

In 2011 the project was stopped after spending 160 million NOK. The event became a national scandal in the media, and an inquiry was conducted at the Norwegian Parliament. 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). At HSE the decision was taken rather quickly in 2012; because of contractual and procedural issues, “hybrid architecture” was chosen. It 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. A large program, *Digital Renewal* with a budget of around 1 bn. Euro, 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), was established to program the numerous physical integrations between the central EPS and the other clinical and administrative systems. The key project, implementing DIPS with the needed integrations, was successfully run in 2013-14. The other health regions, with one exception, 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 acquire EPIC. However, a new discourse was entering the field in 2014.

5.2.3 Shift 3: From integration to Innovation

During 2014 it became clear although that the Digital Renewal approach was successful, it was quite expensive, and it provided few new services, since most of the resources went to integration. 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. Also, 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. As a response, HSE 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, quickly established relationships with various clinicians and upstart IT companies, and in 2015 a number of pilot projects were initiated. 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.

6. ANALYSIS

In the theory section we outlined the Foucauldian “space of interplay” and how it is used by discursive formations gathering around an object. The discursive formations have power to intervene, change the trajectory of programs and systems, to implement and institutionalize the rules and regulations. In the findings sections the rise and fall of e-health programs in Norway in a 15-year period were described.

In the analysis section we will first discuss the shifting trends from the perspective of how they arise and their content. Second we will discuss some possible implications of the cycles of opening and closure of infrastructures from a governing perspective. The result of the analyses is a description of the way from the discourse to infrastructure, that is, how the interplay creates and uses spaces of possibilities to complement or improve the leading program. This relates to Lakatos claim that programs tend to continue, in spite of acknowledged shortcomings, until an alternative exists. We are interested in how these alternatives arise within discursive formations addressing the problem with the infrastructure.

6.1 Establishing Spaces of Interplay

The shifting trends of e-health programs are driven by discursive formations addressing acknowledged shortcomings, establishing power around a common vision and a common object. Table 2 (below) gives a summary of our analysis.

The first discursive formation, the “Message-boost”, address the shortcoming of the pre-2001 projects dominated by paper and fragmented digital products. The decentralized organization of the pre-2001 programs was extended, but by trying to build a layer of “message-based interaction” on top. This was the result of the need for cooperation within and between health units. The slow progress and extended challenges with fragmentation led to the first shift. The media “choruses” wrote about medical records transferred between hospitals using taxi. The clinicians complained about having to log in to a broad range of different non-integrated systems, and about the mix of paper and digital routines. The software suppliers differed in each region because of the local autonomy the hospital had to order the solution it preferred, and when the hospital had common systems they had different versions of them. The extended fragmentation was partly seen as caused by local autonomy and it led to huge challenges both in providing patient orient care and evidence based medicine.

The popular discourse on IT-Architecture and especially the modularized version of it, the Software-Oriented-Architecture (SOA), led to the gradual establishment of the Portal Project. The Portal Project both addressed the problem of digitalization and fragmentation in that all medical systems were consolidated within a “clinical work surface”. The visions of modularised architecture - empowered by Gartner, SOA standards as well as the report from

the Norwegian ICT unit “National ICT” – strengthened the trend. A big amount of e-health stakeholders discussed the flexibility of the modular strategies as well as the strong orientation towards international suppliers. The “Hybris” of this vision led to a project which when it was aborted had the price of 160 million NKR, around 18 million euros.

The collapse of the Portal Project led to the second shift which became a return to older strategies of Integration between the newly implemented patient record and the existing systems. This shift was conditioned by the necessity to move to something “safe” very fast, and few solutions were available after the hastily collapse of the portal. The shift led however to one of the biggest ICT projects in Norway, “Digital renewal”, with a price tag of around 1.2 bn. euros. The last shift is touching upon a general tendency in the e-Health environment. Digital Renewal as other centralized and standardized programs gradually remove some of the local autonomy and local innovation. This leads to the need to complement the big software programs with extensive roadmaps, with faster projects which focus more distinctly on innovation. One solution to this may be cloud based architecture, but the discourse is generally more occupied with the increasing distancing in space, between area of clinical decisions and area of strategical decisions, and in time, between the point when a requirement is acknowledged by clinical personnel and the time this solution is implemented in the clinical systems.

Table 2. Discursive formations and space of interplay

SHIFT	Discursive formations	Dominating Program	Acknowledged shortcoming	Common vision	Common Object
	Message Boost	Local Projects	Paper based records	Cooperation	Message-based interaction
Shift 1	IT-Architecture	Portal Project	Slow progress, fragmentation	Modularisation	Modular Architecture
Shift 2	IT-Architecture	Digital Renewal	Collapse of Portal	Integration	Integrated Architecture
Shift 3	Innovation	Digital Renewal	Lack of innovation and decentralized autonomy	Innovation and decentralization	Cloud-based Architecture

6.2 Understanding the Space of Possibilities

Discursive formations establishing spaces of interplay provides possible solutions to acknowledged challenges with the dominating program. The emergence of alternatives (in spaces of interplay) creates an opening (a space of possibilities) where the alternatives usability is measured. By analysing our data, thus, we identified a repeating pattern of interaction of discourse and growing infrastructure. We analyse this pattern in terms of space of possibilities. The dynamics is illustrated in Table 2 below.

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Table 3. Cycle of discourse formation shift

Phase	Step	Description	Effect
De-stabilising	1	A problem is experienced in the information infrastructure	Space opens
	2	An alternative is presented and discussed	Space is open
Stabilising	3	The discourse converges on solution	Space closes
	4	Decision is taken on new approach	Space is closed

The cycle includes two phases and four steps. The first phase describes how established discursive formations is destabilised through two steps; first by a perceived problem at the infrastructure level, and then the discourse on an available solution to the problem. For instance, in the described Shift-1, there was growing dissatisfaction with the “message approach” to connect various IT silo solutions. However, it was the discourse on SOA that really opened the space of possibility. When the space of possibility is open, the discourse often includes many actors (managers, academics, vendors and, in some cases, the general public), and is usually a competitive arena for new initiatives. For example, in the described Shift-2, the dominant EPR vendor worked hard, and succeeded, to solve the portal scandal by a quick decision to choose the DIPS solution. Potential conflicts were mitigated by consensus outside the contractual frame agreements, after 2011-2012 statements about “portal” lacks a common field of association from where discursive formations establish themselves.

Closing the space of possibility is a process of stabilisation; first the convergence of the discourse through alliances of key actors, and arguments of the benefits of the new approach, followed by formal decisions. In some cases, this is done quickly, as in Shift-2, while the process of Shift-3 is likely to take much longer time. However, after the decisions are taken, and the space of possibility is closed, the discourse becomes much more muted, and actors on the losing end will need time to reposition themselves.

7. DISCUSSION

In this section we return to our research questions. We add to the existing literature on the role of discourse in IS in our two contributions:

- We propose a model for understanding the dynamics of discourse and infrastructure
- We extend information infrastructure theory by including discourse as a key factor in infrastructure evolution

Our case illustrates that the e-health field is characterised by shifts of discursive formations. How they occur and creates spaces of interplay as well as their content was described in the findings and theorized in section 6.1. The insight into discursive formations enables an understanding, not only of political and strategical consensus and compromises, but some of the mechanisms that leads to growth. The discursive formations address solutions, sometimes pragmatically, sometimes idealistically. The programs are sometimes based on organizational and technological legacy, and sometimes on emerging trends which promises path-breaking solutions. The cyclical dynamics of these shifts were theorised in our four-step model (section 6.2), which explains how the discourse and programme events influence the

space of possibility. This extends the earlier research on IS discourse dynamics which primarily focus on the formation, but does not deal with the cyclical shifts. Our model, building loosely on Lakatos' (1970) work on programme shifts, shows that there is a repeating pattern of interaction in these shifts. We also shed light on how managers relate to this dynamic. When problems occur in a current strategy or project the managerial response will usually be to try to solve them, not to question the whole approach. However, when the discourse on the issue moves from problems (step 1) to alternatives (step 2) some managers may engage in the new discourse, and contribute to open the space of possibility. In the convergent step (3) managers may try to reposition themselves in order to play a role in the new strategy, and in the final decision step (4) managers will aim at closing the discourse, and focusing on "getting to work". We also contribute to information infrastructure theory (Ciborra et al 2000, Hanseth and Lyytinen, 2010), which has not dealt much with discourses, with the exception of Ellingsen 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 formative role of the installed base, as they often play an important role in the evolution of information infrastructures. In particular, as our case vividly illustrates, discourse plays a key role in strategy shifts. While Ellingsen and Monteiro highlighted the flexible character of organising visions (allowing actors with different interests to converge), our findings document both an elaboration of the "nature" of the movements which leads to the shift, how they occur and their content, as well as a more detailed trajectory of the cyclical nature of infrastructure discourses and programs. Our findings, thus, also gives input to governing problematics.

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