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Governing the Implementation of a Complex Information Systems Network: - The Case of Finnish Electronic Prescription

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Abstract

This paper reports briefly preliminary experiences from implementation case of a complex health care information system, namely Electronic Prescription System (EPS). Theoretical approach of the study is built on inter-organizational networks and their governance. The author claims that the Finnish implementation pilot was a relative failure from network management perspective. Statement is supported by semi-structured interviews collected during the evaluation process.

Keywords

Electronic Prescription Systems, health care, implementation, network,

INTRODUCTION

Health Care Information Systems (HCIS) and their research have been of increasing interest during the couple past decades as health care organizations have been seeking for quantitative and qualitative benefits in their operation and health care information systems have been seen as one remedy for rationalization of health care. (Raghupathi 1997; Thornett 2001; Wang et al. 2003)

Health care IS research has so far mainly concentrated on intra-organizational research whereas inter-organizational relationships have been of lesser importance. This is natural as focus of HCIS development has been until recently in intra-organizational systems; whereas inter-organizational IS networks are still relatively new phenomena in health care. (Johns 1997; Grimson et al. 2000; Raghupathi and Tan 2002; Gagnon et al. 2005)

Today, health care organizations are facing new operational environment as previously isolated organizations are networking to other health care actors. The trend seems to be towards development of large-scale, integrated organizations that offer the benefits of coordinated care and more effective monitoring and enhancement of clinical practices; processes in which information systems are expected to play a crucial role. (Robinson and Casalino 1996; Gray Southon et al. 1997; Mercer 2001)

Furthermore, health care generally speaking, has been late adopter of information and communication technology (ICT) and similar inter-organizational connections that have existed several years in e.g. banking are only now emerging in health care field. Reasons for this, among other things, are underinvestment in IT, lack of political will, fragmented markets with inadequate revenue streams to support development of new systems, lack of standards or slow adoption of them. (Grimson et al. 2000; Khoubati et al. 2006)

Yet, researchers agree that new technologies have potential to improve the functioning of health care; the difficult part is that that potential can only be achieved if healthcare information systems can be successfully developed and implemented. (Johns 1997; Armoni 2000; Heeks et al. 2000; Armoni 2002; Raghupathi and Tan 2002)

The purpose of this paper is to introduce briefly preliminary experiences from implementation case of a complex health care information system, namely Electronic Prescription System (EPS). Electronic prescription systems are one example of the use of inter-organizational information technology in health care, and these types of systems have been or are being implemented in several European countries and the USA during the past years (see e.g. Salmivalli & Hilmola 2006) According to Vrakking (1995) the main question in implementation is: How can we create, with minimum effort and cost, the best possible chance that implementation of intended and approved complex innovations will actually take place?

Theoretical perspective of the paper focuses on the governance of networks and the research questions are:

1. What is the intrinsic rationale to implement electronic prescription system?
2. How is the implementation of EPS network governed?

NETWORKS AND GOVERNANCE

The basis of theoretical framework in this study is built on inter-organizational networks and their governance. Networks and their governance have been researched for decades from several different disciplinary and theoretical approaches (On networks see e.g. (Benson 1975; Cook and Emerson 1978; Ouchi 1979); In governance: Coase's (1937) governance forms, Transaction Cost Economics by Williamson (1979), Jones et al. (1997) etc.).

This paper studies network governance especially from policy network perspective accommodating the special features of health care and inter-organizational information systems (IOIS) implementation domain. Research in this domain is still relatively juvenile, but there is apparent need for research in the field as the health care is moving from single patient-doctor relationship towards seamless care (Grimson et al. 2000).

The term *network* illustrates the several interdependent actors involved in delivering services. The *networks* consist of organizations which need to exchange resources (information, money, expertise etc.) to attain their objectives, to maximize their influence over outcomes, and to avoid becoming dependent on other players in the game. (adopted from R.A.W Rhodes, foreword of (Kickert et al. 1997b)).

Governance is described on general level as 'directed influence of social processes', covering all sorts of guidance mechanisms which are connected with public policy processes. The forms of guidance are not restricted to conscious or deliberate forms of guidance. Nor is governance limited to public actors (adopted from (Kickert et al. 1997a) see also e.g. (Jones et al. 1997) for definitions of network governance).

Network management then is an example of governance and public management in situations of interdependencies. It is aimed at coordinating strategies of actors with different goals and preferences with regard to a certain problem or policy measure within an existing network of inter-organizational relations. (Kickert et al. 1997a)

The differences between public and private sector management have been discussed widely in management and organization sciences. Allison (1980) has classified the differences into three groups:

1. **Differences in environmental characteristics:** market exposure, legal, formal constraints, and political influence
2. **Differences in the relationship between environment and organization:** coerciveness, scope of impact, public scrutiny and expectations
3. **Differences in organizational factors:** goal complexity, authority relations, performance, incentive structures and personal characteristics (from (Kickert and Koppenjan 1997))

Furthermore, traditionally the operating environments of organizations have been divided into *Markets* and *Hierarchies* (Williamson 1975) and later Ouchi (1979) added *Clans* (Community) into classification, and their control mechanisms are respectively *Price*, *Authority*, and *Trust*. (Adler 2001)

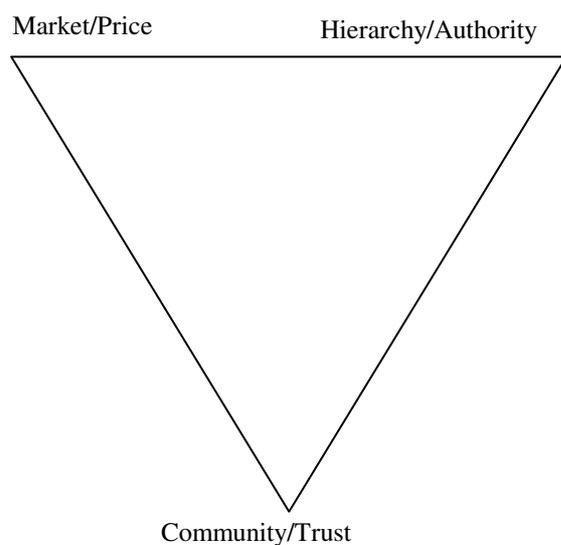


Figure 1. Organizational models and their coordination mechanisms (Adopted from (Adler 2001))

Hierarchies and markets have been revealed to illustrate poorly health care field (Glouberman and Mintzberg 2001). Hierarchies do not solve the problems of cost control or coordination. On the other hand, markets separate sellers of like products from each other by the order of competition so that each actor is encouraged to work independently, which usually is not the case in health care field.

Trust (Community) as a control mechanism seems to fit quite well in the health care field (Gilson 2003), but cannot be the sole building brick as, at least in Finland, health care has elements of hierarchy deeply rooted in the system (e.g. strong Ministry/legislative steering) and there are also elements of market orientation (e.g. private pharmacies and private sector health care providers). Therefore, it seems that we cannot solely rely on any single control mechanism of Authority, Price, or Trust.

Governance in complex networks requires distinctive management practices from traditional public sector management: Government is not the single dominant actor that can unilaterally impose its will, hierarchical, central top-down steering does not work in networks that have no 'top'. (Kickert and Koppenjan 1997) All in all, network manager operates from a comparatively powerless position with little hierarchical means at its disposal, yet there are several different strategies that network manager can utilize. (Kickert et al. 1997c)

Kickert et al. (1997) propose three different perspectives or 'ideal types' of network management:

1. **Instrumental perspective:** is refinement of classical rational 'steering' approach. Main argument is that regulatory instruments do not apply in a network situation because they are uniform and one-sided. In network situation more refined instruments, like incentives, communicative instruments or covenants should be employed.
2. **Interactive perspective:** stresses the multitude of actors, and especially their interactions. Network management is about contributing to and providing conditions for the process of finding a common purpose more than attaining governmental goals.
3. **Institutional perspective:** emphasizes the role of institutions which shape the strategies and intentions of actors. Network management has to build upon these institutions.

Table 1. summarizes the main features of these three perspectives Adapted from (Kickert et al. 1997c).

	<i>Instrumental perspective</i>	<i>Interactive perspective</i>	<i>Institutional perspective</i>
Research focus	Improving steering conditions	Cooperation	Network arrangements and their impacts
Level of analysis	'Focal organization'	Interaction	Network
View of policy networks	Closed and pluriform object of steering	Horizontal interaction situation	Product and context of interaction and governance
Characterization of network management	Strategic use of steering strategies and treatment of dependency relations	Furtherance of co-operation and prevention and removal of blockages	Incremental adaptation of incentive structure and rules of structure and culture of policy networks
Criteria for evaluation and prescription	Effectiveness; Problem solving	Satisfying policy; consensus and openness	Openness, robustness, facilitating interaction
Strong points	Applicability; Consistent with steering ambitions of government	Realization of cooperation in pluralistic situations	Interest in role of institutions and institutionalization; Cautions against easy structural solutions
Weak Points	Limits to steering in connection with goal orientedness; danger of instrumentalism	Too little attention to institutional aspects; Danger of particularism	Limited manipulability of variables

Table 1. Three perspectives on network management (Kickert et al. 1997c)

In the general strategy literature, strategic actions are usually characterized as efforts by actors to manipulate (change or preserve) their position(s) in network. The three above presented perspectives possess diverse strategies to achieve desired outcome. In brief, instrumental perspectives strategies are aimed at the realization of fixed goals or the solution of a well-defined problem. From an interactive perspective strategies are aimed at influencing ideas and perceptions of actors to improve the opportunities for common action (e.g. attempts to collectively adjust strategies and goals). The institutional perspective focuses on the long term impact of game strategies on the network as a whole, and is not so committed to particular goals or policies. (Kickert et al. 1997c) see also (Agranoff and McGuire 2001; Agranoff and McGuire 2003)

Implementation situation (e.g. implementing inter-organizational information systems) in networks has some special features compared to more 'static' network environment. One of the major differences is the need to attend to the developing, maintaining and utilizing of common purpose within and across functionally specific clusters of interrelated actors. Usually the tasks to be performed in implementation phase are more concrete and narrow as well. O'Toole et al. (1997) list three strategies fitted especially for implementation phase: *Bargaining and Compromising*; *Changing Perspectives*; and *Managing the Context*. (O'Toole et al. 1997)

RESEARCH METHODS

The work presented in this paper is part of a larger study in which the implementation of Finnish EPS is studied. The author has been participant in inter-disciplinary team evaluating the Finnish ePrescribing pilot. Research approach has been throughout the study action research, in which researchers are in a 'helping role' within the organizations that are being studied (for action research see e.g. (Rapoport 1970; Baskerville and Wood-Harper 1996; Grant and Ngwenyama 2003)).

This paper follows interpretivistic paradigm (see e.g. (Chen and Hirschheim 2004)) and empirical part of this paper reports findings from fifteen semi-structured interviews made to main actors in the Finnish ePrescription pilot. Interviewees were on the management level in their organizations. Patient perspective is demarcated outside the scope of this study. There were ten themes with sub-questions; this paper reports the responses from *entry and expectations*; and *organization of the project and rules of game* –themes. The interviews were recorded, transcribed to text document and analyzed with qualitative analysis software (NUDIST Vivo).

The paper at hand focuses especially on the implementation of Finnish electronic prescription system from network perspective. Previously Finnish EPS has been reported from e.g. infrastructure perspective (Hyppönen et al 2005), business model perspective (Salmivalli & Hilmola 2006), interdisciplinary evaluation perspective (Hyppönen et al 2007), and from the comparison of different national implementation strategies perspective (Hyppönen et al 2006).

ELECTRONIC PRESCRIPTION SYSTEMS (EPS)

Electronic prescription systems are expected to solve several challenges in health care: rationalizing medication practices of physicians, providing up-to-date information on the cheapest medication available, reducing overlapping medication, reducing medication errors and adverse drug interactions, decreasing prescription handling costs, and increasing efficiency in several organizations. Furthermore, electronic prescriptions are expected to provide more accurate and up-to-date statistical information about medication practices in relation to these issues and hence increase the efficiency of pharmaceutical distribution and improve the planning of national health policy in the long run. (Niinimäki and Forsström 1997; Mundy and Chadwick 2002; Schuring and Spil 2002; Boonstra 2003; Mundy 2003; Schuring and Spil 2003; Bastholm Rahmner et al. 2004; Boonstra et al. 2004; Spil et al. 2004)

Different Electronic Prescription Systems have been implemented, or are being implemented in several European countries and America. Among implementing countries are at least Canada (Taylor and Tamblyn 2004); Denmark (Demkjaer et al. 1999); Germany (Brill et al. 2005); the Netherlands (Schuring and Spil 2002; Boonstra 2003; Spil et al. 2004); Portugal (Freire 2006); Spain (Pina Vera 2006) Sweden (Bastholm Rahmner et al. 2004); The UK (Mundy 2003; Mundy and Chadwick 2004); and the US (Teich et al. 2005).

However, the starting points and context, implementation process and technical solutions for EPS differ from one country to another. Merely, the concept of electronic prescription differs from electronically created and printed prescriptions to electronically transmitted and processed prescriptions. In this paper we use the terms ePrescribing and Electronic Prescription System (EPS) to denote the entire system with different actors and subsystems.

There is still very little research made on the comparison of EPS in different countries (Hyppönen et al 2006) but it seems that the most important common denominators for EPS projects are that: A) There is vigorous motive on national levels to implement EPS in order to e.g. resist rising medication costs (Taylor and Tamblyn 2004) and B) EPS-projects are always inter-organizational in nature, systems are implemented in several different

organizations at the same time, organizations are usually heterogeneous in size, operate in different areas of health care field (e.g. pharmacies, hospitals, imbursement authorities), and they possess different legacy information systems.

THE CASE: IMPLEMENTING EPS IN FINLAND

Overview

Electronic prescription in Finland dates back into 1990's, when alternative technologies were piloted locally, including the point-to-point email solution, card-based systems with a national medication record and prescription database trials. Analogous problems were encountered in all of the local pilots: inadequate attention to the entire process of prescription data processing, lack of attention to patients' rights, data security and technological interoperability, lacking agreement about financing the system and rights to access the data as well as lack of national regulation. (Hyppönen ed. 2005, 2006)

In 2000 the Ministry of Social Affairs and Health set a project to draw conclusions on experiences of the local trials and to suggest a national concept for ePrescribing in order to harmonise the development. In 2001 was published a preliminary disquisition about electronic prescription in Finland. The report concluded recommending a national database-system with access to doctors, pharmacies, Social Insurance Institution and later also patients. (Social Insurance Institution 2001) In 2002, the Finnish Ministry of Social Affairs and Health started implementing the national concept suggested in the report by selecting units from health care organizations and a couple of nearby pharmacies in four different regions to pilot the national concept described in the report. A national steering group coordinated the locally organized pilots with a small budget. An experimental decree on ePrescribing was issued in 2003. It laid down provisions among other things on preparing, signing, technical content, altering and delivery of electronic prescriptions.

The construction of the system took 2 years, and the first clinical pilot started in 2004. By the end of 2004 two out of the four piloting health care units had implemented the EPS integrated into electronic patient record (EPR), pilot pharmacies still used a stand-alone system, which was not integrated into pharmacy systems and created extra work at the pharmacies. In June 2005, the third integrated EPS and the first integrated pharmacy system were implemented.

Furthermore, in the spring 2005 the organization of the national e-prescription pilot was changed thoroughly; the part time project manager of the pilot was changed to a major consultancy company, which re-organized the administration of pilot entirely. The amount of produced e-prescriptions remained still very small and at the end of 2005 only approximately 800 electronic prescriptions had been dispensed (there are approximately 40 million dispensed prescriptions in Finland annually). In June 2006 the ePrescription pilot was ended, because it had "reached the objectives set to it". Interviews used in this paper were collected before the pilot administration was re-organized.

Figure 2. describes the network organization of the national e-prescription pilot, actors included in the figure were mentioned in the preliminary disquisition (2001) as stakeholder organizations for e-prescription pilot. Solid line presents actual information system connections to the EPS and dash line portrays formal or informal influence on the EPS system. Stakeholders are arranged in a such way that authorities are in the upper part of the figure, associations and trusteeship organizations on the left side and software providers and other commercial actors are at the bottom of the figure.

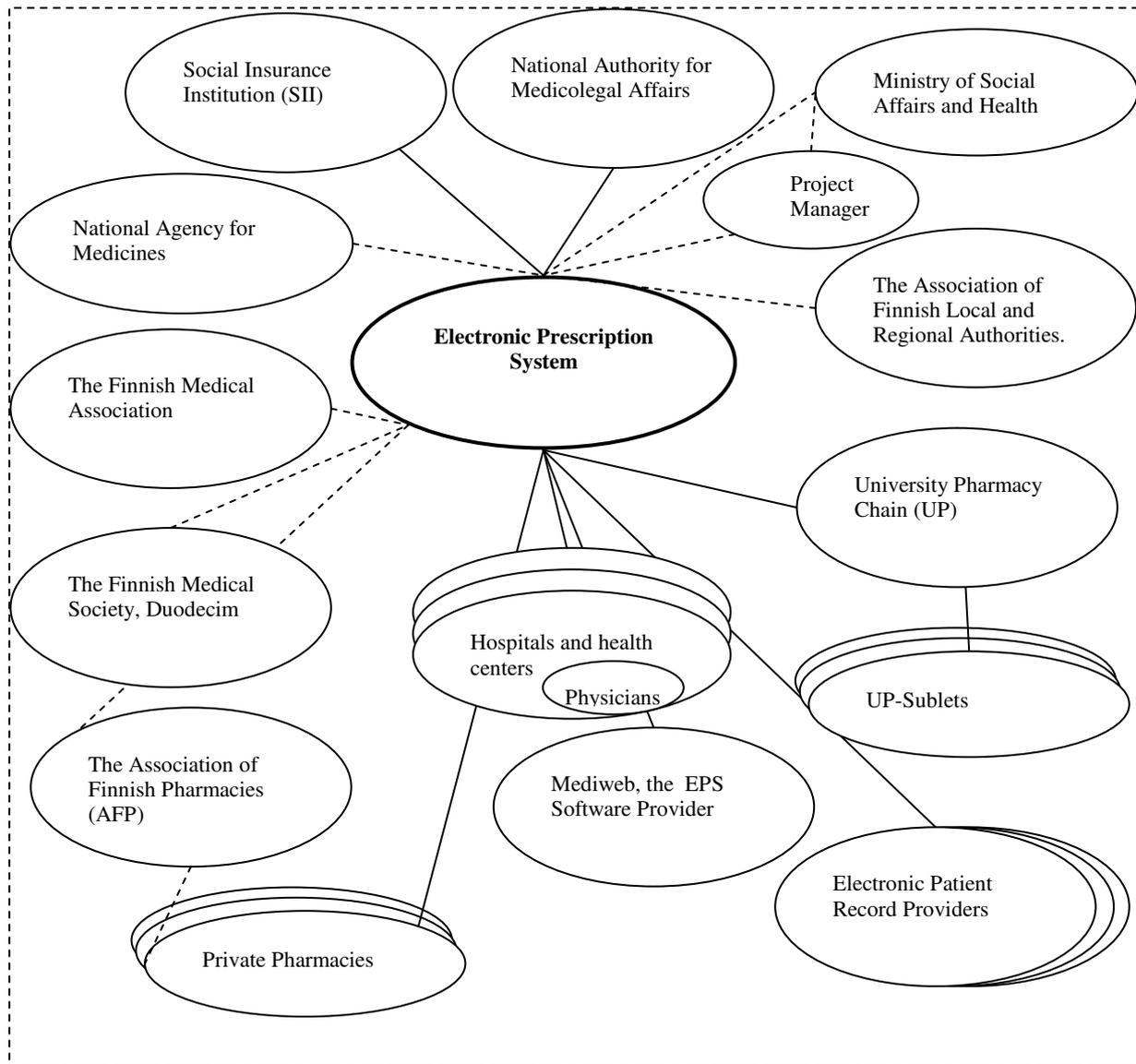


Figure 2. The network structure of Finnish EPS

Motives to implement EPS

Prerequisite for successful IS network implementation is the motivation of actors for cooperation in project. An IS network project has little odds to prosper if all the actors perceive project goals completely differently. Respectively, one of the main missions for project management is to mesh together different interests to reach a common objective.

In our research the author identified three levels of goals or objectives: *National level motive to implement EPS*; *Organizational level motive*; and *User level motive* (users are physicians and pharmacy personnel). Interviewees were asked their own motives and objectives on the pilot (i.e. reasons to participate the implementation pilot), what they presumed was the national reason to launch the pilot, and if there were any conflicts of interests between actors or individual actors and national objectives.

Based on the interviews, we can say that there is exceptionally wide understanding that there is clear *raison d'être* on the national level for ePrescription system. All interviewees shared mutual understanding that EPS pilot is needed and that it could generate benefits on the national level. Expected benefits mentioned related to rationalization of medication and medication costs, bringing health care up to date and increasing the productivity of health care generally, and improving the quality of care (e.g. less errors in prescriptions). However, respondents criticized that the Ministry of Health had not expressed the national objectives clearly. There was no unambiguous vision of EPS, nor was there any exact milestones or clearly expressed objectives to be reached in set time.

All organizations claimed that they are committed to national implementation project, and generally respondents didn't see that there were any major conflicts of interest, only that different actors emphasise different issues which has slowed down decision making, e.g. differing opinions about data security level was mentioned most often. Yet, five respondents reported that a certain trusteeship organization is having its own agenda, and is hindering the work of steering group.

Organizations participating in the pilot did not receive any financial incentives for participation, but instead they were expected to allocate resources for the pilot. Hence, all of the individuals participated the project among their other tasks. Part-time project manager was only person receiving salary from the project, software vendors naturally billed for the development work which was funded by the Ministry.

Interviewees did not expect financial savings from the system; on the contrary, organizations expected EPS to create more costs in terms of IT-personnel and upgrading of existing systems. Main benefits expected were related to time saving and quality improvements in care. Based on interviews it seems that costs and benefits appear on different levels. Costs seem to be concentrating on individual organizations shoulders whereas benefits generate on national level, and are often difficult to calculate (e.g. how to calculate improvements in life quality due to more rational medication of patient).

Organizations involved in the pilot were surprisingly committed considering the fact that generation of actual benefits is somewhat tentative, and would anyways require that significant proportion of all prescriptions would be electronic. As long as there are two systems: one for the paper prescriptions and one for electronic prescriptions, the benefits are not generated – at least in full scale – but instead costs of both systems are running. Pioneer spirit and possibility to have an influence were mentioned several times as motive to take part in the pilot.

User level motivation was the third identified dimension affecting the implementation project. User level motivation is twofold: primary users are doctors and pharmacy personnel. Based on interviews, it seems that critical success factor is user acceptance of physicians. Pharmacy personnel have lesser choices, as they have to dispense prescriptions regardless their format: paper or electronic. Physicians, on the other hand, can choose between paper and electronic prescription and threshold to use ePrescription may be considerable high if they don't perceive advantage from using EPS. Interviewees stated that user feedback from the system was that it was slow to use and physicians had to explain patients the data security issues related to system and ask their written consent, which in turn created extra work and loss of time for physicians.

The governance of EPS implementation network

The governance structure of Finnish EPS pilot is exceedingly complex network with several different dimensions. Firstly, there are several authorities involved in the network; one governance challenge is that there are two powerful players: Ministry of Health and Social Insurance Institution (SII). SII is under parliament control and Ministry does not possess formal power on SII. Secondly, local health care actors have wide-ranging self-government and possibilities to affect local decision making are limited. Third issue are the private actors, e.g. private pharmacies and software vendors acting on commercial basis, and a major question is how their actions can be steered. Fourth institutional field consists of different trusteeship organizations acting in the interest of their principals.

There was a wide understanding among interviewees that organization of the project has been a failure. Time scale of the project had been drawn out constantly, the pilot was under-resourced both in terms of money and personnel, and responsibilities were not clear. Several interviewees reported that steering group was too large, and decision-making was difficult. Decision-making was aggravated further because there was no prepared drafts on basis of decision making.

Part-time project manager had little means to influence the network. There were no rewards to be offered for good performance, nor penalties for under performance. Hence, main tools to be used were based on actors voluntary cooperation. Furthermore, project manager did not have whole-hearted trust of all actors, which in turn was seen to complicate management.

Based on interviews, the managerial perspective falls into *interactive perspective* discussed above. Despite of the strong commitment of participating actors the Finnish EPS pilot was not a success story. The amount of electronic prescriptions remained insignificant compared to aggregate volume of prescriptions, or even phone prescriptions (the physician calls to a pharmacy to order medication for the patient).

CONCLUSIONS AND SUMMARY

Provan & Milward (1995) claim that in the public sector, where a strong public interest is involved, network outcomes are particularly significant, and the motivation for organizations cooperating to accomplish system

goals rather than organizational ends is often stronger than in the private sector, even when specific incentives to integrate and cooperate are weak. (Provan and Milward 1995)

For one, our research would indicate quite the opposite. Networked organizations can have strong commitment in a project, but network governance can still fail. Firstly, the rationale to implement EPS remains still problematic issue. EPS is first of all national level mission, and in its current form it provides little incentives of use for individual organizations and users. Yet, even at the national level goals and objectives were vaguely expressed from the beginning of pilot.

One of the main objectives of network management according to interactive perspective is to find common objective for the network. Based on our research it remains uncertain whether common objective benefiting all participants was really found. Positively, all organizations claimed to be very committed to the pilot and its objectives.

As the expense of entry was comparatively low and expected benefits for participants relatively precarious organizations may have joined the pilot "just in case". Second possible explanation is opportunism and wielding of power. Studies argue that introduction of telemedicine (e.g. EPS or other health care IS) increases bilateral dependence (lock-in) between health care actors. Approving this line of thought, it is essential for the relationship to be continuous if the benefits of the IS investment are to be realised, but such continuity exposes the relationship to opportunistic behaviour, as assets cannot be easily re-deployed. (Pelletier-Fleury and Fargeon 1997)

Based on this study It seems evident, that A) network perspective of complex health care IS project needs further study and critical evaluation (see e.g. (Hardy and Phillips 1998) for excellent presentation of inter-organizational collaboration), and B) such complex network settings need more effective steering methods to be successful (e.g. focusing strategies based on Ouchi's triangle presented on figure 1.). There is still very little research on private-public networks and health care governance forms in complex network settings. It seems evident that further research and critical evaluation about objectives, rationale, and management of HCIS is needed.

The evaluation team provided national steering group continuous feed-back and produced two bigger reports (Hyppönen ed. 2005, 2006). National pilot changed its direction during the evaluation process: pilot steering group was re-organized, and a question of *National Actor* was raised. National Actor would be the "owner" of the system, and hence clarify management issues. Many of the troubles were solved during the first pilot phase, but usage rates remained disturbingly low.

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