

Exploring ICT Enabled Networking in Hospital Organisations

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Abstract

This paper describes an exploratory study of new organisational forms in hospitals. The study focuses on ICT-enabled networking in hospital organisations. Two Dutch hospitals (one general and one categorical) and a German hospital (university) were analysed. Hospitals develop through different levels of networking and phases of organisational focus. Strategic drivers and incentives are improvement of efficiency and effectiveness of the primary care process. Enabling conditions are a clear hospital strategy and an open and flexible hospital information system that supports network transactions and processes. The design and functioning of the network is conditioned by (a) the not-for-profit market, (b) the organisational focus, and (c) the involvement of internal and external stakeholders. The measurability of performance increases as the organisational focus evolves. More research is called for to understand the complexity and dynamics of hospital network organisations.

1. Introduction

The health care sector is experiencing fundamental change, especially in and between hospitals (Tanriverdi and Venkatraman, 1999 [18]; Spil et al, 1999 [17]). While the role of information and communication technology (ICT) is certainly not new, the increasing dynamics of organisational and socio-economic developments, and the rapid technological advancements do emphasise the complexities and dynamics of a changing health care environment (Peterson et al, 1999 [11]).

Hospitals are subject to constant impulses from the national government and insurance companies to improve efficiency and effectiveness. For example, budget restrictions by the central and local government make it necessary to improve efficiency and to reduce costs; the general need to improve patient care makes it necessary to

improve effectiveness. Hospitals are now becoming aware of the potential value of integrated services and the collaborative advantage of networking (Smits and Van der Pijl, 1999 [14]).

In this paper, we focus on new ICT-enabled network organisational forms in hospitals. This study was conducted as part of a large-scale research programme on network organisations in health care and other industries. The ultimate aim of the research is to understand and improve the effectiveness of ICT-enabled networking in hospital organisations.

More specifically, the research questions are:

- (i) What are the strategic, organisational and performance features of hospital network organisations?
- (ii) What are the relationships and roles of the various stakeholder groups?
- (iii) What is the role of ICT in hospital network organisations, and how is ICT organised and managed?

Section 2 provides a theoretical background on network organisations in general and describes the research model underlying this exploratory study. The different organisational foci in hospitals, and the roles of stakeholders and ICT are outlined. The case studies in three ICT-enabled network hospital organisations are described and analysed in Section 3. More specifically, in Section 4, the changing stakeholder coalitions and the strategic role of ICT are discussed. This paper concludes with the main lessons learned and directions for future research (Section 5).

2. Theoretical Background

In the growing literature on network organisations, different definitions and typologies can be found for describing a network organisation. In general, three

characteristics of network organisations are identified (Snow et al, 1992 [16]; Smits and Ribbers, 1999 [15]):

- (i) the network consists of at least three nodes;
- (ii) each node can decide independently regarding long term relationships with other nodes;
- (iii) the relationship between the nodes must exist for some time and for more than one transaction.

In addition to this definition, two comments must be made. First, a network organisation can exist both inside a company (as a network of departments or business units) and between companies. Second, a network organisation can exist as all kinds of cross sections in a value network, such as a network of suppliers, a network chain of suppliers and clients-organisations.

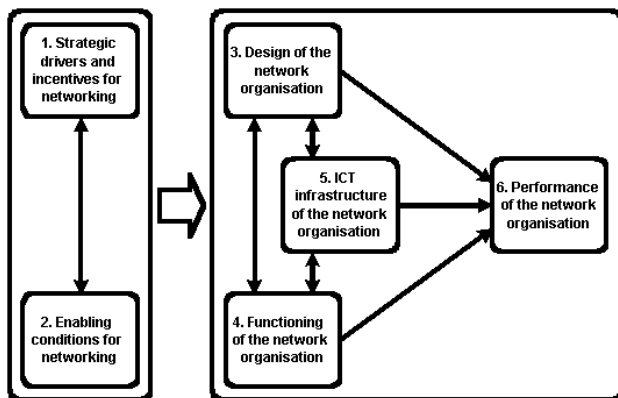


Figure 1 NEFETI research model

To analyse network organisations in practice, six interrelated aspects can be distinguished (Figure 1):

1. The strategic drivers and incentives of the stakeholders and organisations involved in the network (drivers can be commercial goals, improving internal quality, efficiency etc.) (Grandori and Soda, 1995 [2]; Johnston and Lawrence, 1988 [6]; Normann and Ramirez, 1994 [10]).

2. The enabling conditions that stimulated the emergence and growth of the network (for instance the presence of a champion, previous experience with relevant technologies, the absence or presence of network standards). (Johnston and Lawrence, 1988 [6]; Norman and Ramirez, 1994 [10]; Moshowitz 1997a and b [8,9]).

3. The design or structure of the network organisation, e.g. a chain, a star, a dyad, (Grandori and Soda, 1995 [2]); which parties or nodes are involved.

4. The way the network organisation functions, how the nodes in the network cooperate around inter- and intra-organisational processes, (Johnston and Lawrence, 1988

[6]; Norman and Ramirez, 1994 [10]; Van Alsteyne, 1997 [19]).

5. The ICT infrastructure of the network organisation, e.g., the reach and range of infrastructure technologies and services (Weill and Broadbent, 1998 [21]). The role of ICT can vary from relatively simple closed systems (low reach, low range) to open flexible systems, capable of complex transactions between different inter-organisational units.

6. The performance of the network organisation, e.g., measured in terms of ICT and (inter-)organisational achievements and improvement (Grandori and Soda, 1995 [2]; Moshowitz, 1997 a and b [8,9]).

These six aspects are regarded as generic for all lines of industry (see also Appendix A). The aspects can be evaluated at various moments during the development of network organisations. The research model is based on the theory of contextualism. Contextualism builds forth on theories concerned with the organisational, economic, technical and political aspects of strategic change in terms of conditions, arrangements, processes, and outcomes in their context (Pettigrew, 1988 [12]). This study is specifically concerned with the conditions, arrangements, processes and outcomes of network organisations in health care (Walsham, 1993 [20]).

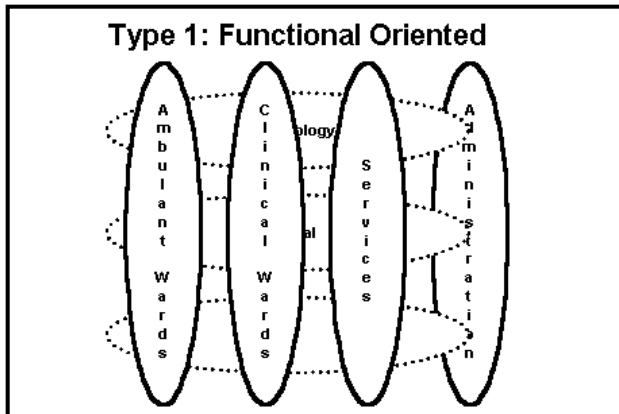
2.2. Network Organisations in Health Care

Network organisations in hospitals can be distinguished at different levels:

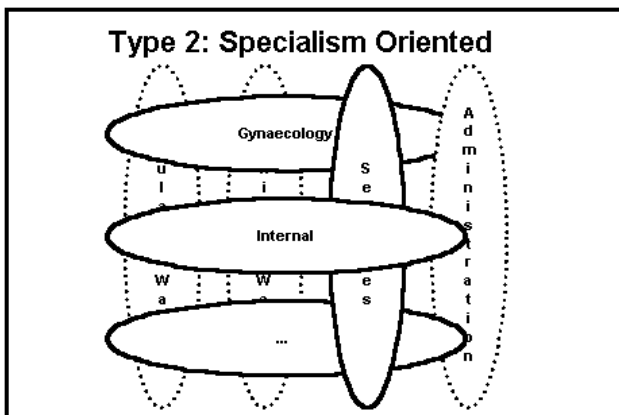
- Intra-departmental: For example within an organisational unit of the hospital the patient's needs are met, crossing the boundaries of the organisational units is not without hindering. Exchange of patients and information between departments is sub-optimal.
- Inter-departmental: For example within a hospital that has is patient oriented across organisational units. In multi-disciplinary sessions (gynaecology, and oncology) the patient's needs are met without the hinder of formal internal boundaries.
- Inter-organisational: For example in transmural care projects the physical boundaries of the hospital are crossed. Patient and information exchange from hospital to hospital or alms home without hindering.

In the past decade, hospitals tended to develop through three types of organisational focus (Lorenzi and Riley, 1995 [7]):

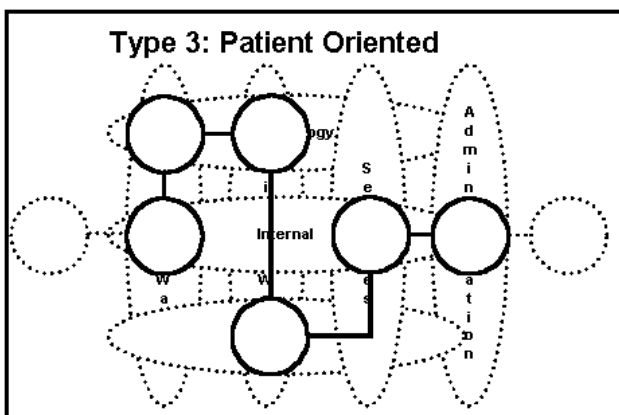
1. Functional-oriented organisational focus;
2. Specialism-oriented organisational focus;
3. Patient-oriented organisational focus.



In the functional oriented hospital, processes are grouped by function. Ambulant and clinical wards, and services are separate organisational entities. Services and administrative functions are also centralised. Specialisms are weakly involved in the hospital top-management.



In the specialism oriented hospital, processes are grouped in strategic business units. Specialisms become more involved in the hospital top-management. Services have the tendency to be centralised, although sometimes they are decentralised for reasons of efficiency and effectiveness. Enabled by ICT the administrative functions become a more decentralised and background process.



In the patient oriented hospital, processes are grouped by flows of patients. Multi-disciplinary teams emerge. Administrative functions and services are outsourced when possible. The management of the hospital becomes more network based. The physical boundaries of the hospital disappear as processes become more transmural.

2.3. Stakeholders of Information and Communication Technology

With regard to the organisation, management and use of ICT, the following internal and external stakeholders can be identified in health care (Glaser and Hsu, 1999 [1]; Hasselbring et al, 2000 [4]). These stakeholders play different roles with varying degrees of involvement.

2.3.1. Internal Stakeholders The *top management* is interested in seamless and cost-effective operation of the hospital. The *administrative departments* expect quantitative information for billing and reports. The *physicians* expect an electronic medical record holding information on medical care and cure, such as prescription and diagnosis, with the possibility to conduct medical research. The *nurses* expect an electronic nursing record and a system for planning the resources such as operating theatres and beds. The ICT department in its role as enabler is mostly technically oriented and interested in clearly defined requirements for their work.

2.3.2. External Stakeholders More and more *healthcare organisations*, such as general practitioners, hospitals, and almshouses have the need to exchange information with each other in order to achieve a shared care for their patients. In theory, laboratory results, admissions and release notification all can be easily exchanged using electronic messages. *Funding institutions*, such as the government and health insurance companies, aim at an effective and efficient use of healthcare resources through deployment of new technologies. The *insurance companies* monitor the use of healthcare resources on behalf of the government. To accomplish that, hospitals have to manage statistical data on different levels of detail, which are not relevant to the primary hospital processes. In a complex ICT environment, such as a hospital, the make-or-buy decision often is in favour of buying. Given the commonly high degree of concentration in the hospital information system market, buying existing ICT solutions and hiring knowledge through *ICT vendors and consultants* implicates restrictions in terms of the ideal 'planned state'. More and more *patients* are getting involved in their treatment. For instance, the growing number of requested second opinions for diagnoses and the use of the legal right for patients to obtain information

considering their own treatment, privacy and data security increase the demands on use of ICT in hospitals.

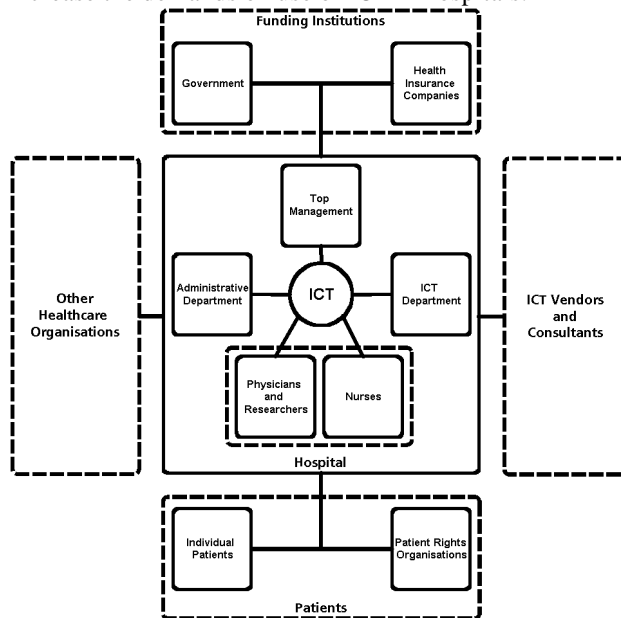


Figure 2: Stakeholders involved in the organisation and management and use of ICT in hospitals.

3. Case Studies

Three case studies were conducted to analyse network organisations in hospitals. The case studies cover the spectrum from intra-departmental to inter-departmental to inter-organisational network organisations.

The studies comprised of semi-structured interviews with directors, department managers, project managers, technical staff and end-users of organisations participating in the network. Project plans and notes were gathered and analysed for further information. Document analysis is used to enrich and verify interview data. The validity and reliability of the study are enhanced through the use of multiple sources of information, the review of draft case reports by the interviewees, and the use of a standardised case study protocol.

The analysis of the case studies is based on the research model, and focuses on the content and interrelationships among the different elements. Case analysis was conducted to identify patterns of similarities and differences within and across cases (Yin, 1994 [22]).

The three cases are described in 3.1, 3.2 and 3.3. An interpretation of the key findings is provided in Table 1.

3.1. University Hospital Leipzig (university hospital, Germany)

The Universitätsklinikum Leipzig (former East Germany) is an academic hospital with a capacity of 1.500 clinical beds and 4.650 employees and 15 locations. Most specialisms have their own buildings, clinical wards, ambulant wards, and service facilities (laboratory and radio-diagnostic). After the re-unification of Germany the Universitätsklinikum Leipzig experienced dramatic reorganisations and updating of ICT. The Universitätsklinikum Leipzig plans to eventually reduce the 15 hospital locations to 3 main locations, and SAP R/3 software is implemented.

In 1996 a ‘Rahmenkonzept für die Weiterentwicklung des Klinikum-Informationssystems’ was made, a general plan for the further development of the hospital information system. Main goals were identified as:

- (i) a central patient database,;
- (ii) an integrated administrative resource planning system;
- (iii) a communication server;
- (iv) a medical knowledge server;
- (v) a clinical workplace system, and;
- (vi) a data communication net.

The demand and supply of ICT is controlled centrally by a common project group of IMISE (Institut für Medizinische Informatik, Statistik und Epidemiologie) and ZMAI (Zentrum für Medizinische und Administrative Informationssysteme). In an annual budgeting cycle, plans concerning ICT priorities are set by a committee.

Main concern in setting priorities is to fit the plans to the budget. A large amount of the budget goes to the current implementation of SAP/R3 modules, particularly for the underlying hardware. Clinics are not free within the hospital policy to substitute a part of their budget to financing plans concerning ICT.

The Universitätsklinikum Leipzig network is perceived as successful when higher efficiency and effectiveness in control are reached, resulting in reduced costs without loss of quality in hospital healthcare. Financial and business outcomes contribute to the whole of the Universitätsklinikum Leipzig. Flexibility in organisation and ICT remain key factors in enabling the network organisation. Universitätsklinikum Leipzig has regional and national collaborations with other general and university hospitals. One would expect, considering the strong curative position of General Practitioners in Germany, that from efficiency and effectiveness perspective, networking would be more common.

Stated reasons for (future) networking are:

- marketing (attracting the ‘right’ patients);

- efficient and effective use of capacity and competence resulting in;
- cost reduction.

The current level of network organisation is best described as intra-departmental with major progress in the inter-departmental area. The University Hospital Leipzig is evolving from a functional oriented hospital to a specialism oriented.

3.2. Bosch Medicentrum (general hospital, Netherlands)

In January 1990 the Willem-Alexander Ziekenhuis and the Groot Ziekengasthuis merged into the Bosch Medicentrum. The Bosch Medicentrum is a general hospital, geographically divided in two locations in the Den Bosch area (approximately 25 km²). It has a capacity of 780 clinical beds, 1,900 fte's (full time equivalents), 2.600 employees and 140 physicians (divided in 30 specialisms).

The annual budget is 118 million Euro (1998, the honoraria budget of physicians included), of which 65% is used for personnel, 20% for materials and 15 for the total hospital infrastructure. The Bosch Medicentrum is a traditional user of HISCOM hospital information systems, provided by Hiscom in the Netherlands. The Bosch Medicentrum has regional and national collaborations with other general hospitals, leading to a merger in the near future.

In seeking improved efficiency and effectiveness, the Bosch Medicentrum in 1996 started a reorganisation to evolve from an intra-departmental to a inter-departmental organisation structure. Units (9 Care Units, 8 Supporting Care Units and 2 Service Units) were introduced to give the middle management the flexibility needed. In the Dutch healthcare this process is called 'tilting'.

The maximum size of the Bosch Medicentre network is 2.600 employees and 140 physicians. The network organisation takes place within the hospital. Its units are the nodes in the network. The nodes involve hospital-personnel and physicians, working together, attending to the patients needs. Most physicians form a group within their specialism that has a separate legal entity. They form small companies within the hospital.

Incentives and enabling conditions for networking are influenced to a great extent by national and governmental rules and legislation. Dutch hospital healthcare has several barriers that prevent efficient and effective control of hospital organisations. Hospitals are not-for-profit organisations. The market does not freely determine barriers for entry and exit to this network, hospital healthcare is considered to be a merit-good. One of the main barriers is that the current system of budgeting can

work contra-productive on a micro-economic level (Raad voor de Volksgezondheid, 1999 [13]). Efficient and effective control of hospital organisations depends on ability to determine the relation between input and output (Hofstede, 1981 [5]). Production parameters like admissions, short stays, nursing days and out-patients are still the backbone of the Dutch system budgeting hospitals. In an effort to stabilise the costs of Dutch healthcare lump sum financing is now widely introduced. Obviously these, legislative ways of relating input and output influence the information systems of hospitals (Zuurbier, 1993 [23]). A more specific system of product-definition is needed. These changes demand a higher flexibility of ICT. This is an interesting challenge, most hospital information systems were originally designed for hospitals with a functional management structure.

The Bosch Medicentrum uses the majority of the HISCOM hospital information systems (68 of the 109 modules available. In the area of specific hospital processes, information systems of other providers are used (Harmsen, 1999 [3]). Mainly hospital middle management, the functional operators and physicians are involved in the organisation and management of ICT. For each part of the hospital information system at least one functional operator is assigned (totally 30). The functional operator is stationed at the unit and responsible for the quality and continuity of their part of the hospital information system. Functional operators exchange knowledge with colleagues grouped by care, supporting care and services. Technical support, implementation and central computing facilities are outsourced. The total outsourced costs of hospital information systems in 1998 were estimated at 4,3 million guilders (including 0,8 million guilders depreciation on computer equipment). The top-15 (20 percent) of the information systems induced 70 percent of the costs and 80 percent of the total computing capacity.

The demand and supply of ICT is controlled centrally by an automation co-ordinator. In an annual budgeting cycle, plans concerning ICT priorities are set by a committee. On an informative level plans are discussed in the groups of functional operators. Main concern in setting priorities is to fit the plans to the budget. A large amount of the budget goes to outsourcing, leaving only a small budget for innovation from within the organisation. However, units are free within the hospital policy to substitute a part of their budget to finance plans concerning ICT. In the near future the centrally controlled budget will be decentralised to the units.

The Bosch Medicentre network is perceived as successful when higher efficiency and effectiveness in control are reached, resulting in reduced costs without loss of quality in hospital healthcare. Financial and business outcomes contribute to the mission statement of

the Bosch Medicentrum, i.e. providing a complete and coherent package of medical care that is recognisable and attractive for the patients from the region, in an integrated medical care organisation where employees can work under good conditions. Integrated medical care reaches beyond the organisational boundaries of the Bosch Medicentrum. The first transmural care projects have started. The performance of ICT is determined by how extensively and adequately it supports the network organisation. Flexibility in organisation and ICT remains a key factor in enabling the network organisation.

The current level of network organisation is best described as inter-departmental. The Bosch Medicentrum is a specialism-oriented hospital.

3.3. Roessingh Rheuma (categorical hospital, Netherlands)

Roessingh Research and Development is a research unit of the Roessingh Concern and employs approximately 40 people. The Roessingh Concern has approximately 140 beds and approximately 40.000 rehabilitation treatments per year. It is one of the largest rehabilitation centres in the Netherlands.

The Rheuma network was formed when a proposal was submitted to the Commission for Chronically Ill Patients to formalise and institutionalise communication lines between Medical Spectrum Twente and local clinics, and Leiden University Medical Centre and local clinics. The Roessingh Research & Development joined the Rheuma network in order to provide the technological know-how and services in supporting and enabling telerheumatology services. Their main role can be described as an 'internal' ICT vendor/consultant. The grassroots of the Rheuma network and the role of RRD, originate from 1995, when Roessingh developed from a functional to a specialism oriented hospital, with a focus on inter-departmental networking, through the use of multimedia technology.

Rheumatology requires a multidisciplinary approach across different lines and fields of expertise in health care, for example, general practitioners, physiotherapists, rehabilitation physicians. The level of network organisation is best described as intra-organisational. The Roessingh Rheuma network is a patient oriented hospital.

The strategic objectives of the Rheuma network are to improve the efficiency and effectiveness of rheumatology services in order to meet patients' needs and care, across time and distance. In pursuing this objective, motivations mentioned by the network participants are to develop and formalise effective lines of communication between MST, LUMC and the respective local clinics, to leverage and share rheumatology expertise across the network, and to

exploit internet technology for forming the Rheuma network and enabling inter-institutional communication.

The key enabling factor in the Rheuma network was the collaborative advantage by leveraging knowledge across the network and sharing expertise. Barriers to networking were building stakeholder commitment, communication and trust, spanning the traditional boundaries of the institutions, and financing the network technology and infrastructure (i.e., investments, costs, and reimbursements). By commencing on a small experimental scale and funding by the Commission, these limiting factors and barriers were crossed.

Different stakeholders at different levels take part in the Rheuma network. From an institutional perspective, three constituencies form the network organisation:

- Medical Spectrum Twente (MST) and the local network of physiotherapists.
- Leiden University Medical Centre (LUMC) and the local network of physiotherapists.
- Roessingh Research & Development (RRD) and the Roessingh Rehabilitation Centre (RRC).

Within each institute different stakeholders are involved from levels of general management to the physiotherapists and rheumatologists (users) involved in the telerheumatology services. In total, approximately 180 professionals are involved in the Rheuma network, spread across the different levels and institutions.

Different processes are distinguishable in the functioning of the Rheuma network. Key management processes are network co-ordination and stakeholder management. Frequent face-to-face meetings take place to discuss experiences and future directions. The primary processes and transactions cover telerheumatology diagnosis processes: communication and decision-making; collaboration and knowledge sharing. Within these processes, the main network 'transactions' are the provision of telerheumatology services across the network, the leveraging of rheumatology expertise across the network, the development and supply of multimedia network technology. Technology development processes focused on application and infrastructure design.

Demand and supply of ICT is differentiated across the network. ICT infrastructure is concentrated at RRD, while local applications are managed at MST, LUMC and RRC. The latter organisations are also responsible for ICT demand. A multimedia database - 'the post office' - based on internet technology is used to facilitate the communication and diagnosis of rheumatology cases. Critical requirements are to support the current Rheuma network and to enable a-synchronous multimedia communication, in order to provide efficient, effective, flexible and reliable telerheumatology services. The experiences with the Rheuma network have been successful. Stakeholders have experienced the

Case	University Hospital Leipzig	Bosch Medicentrum	Roessingh
Level of network organisation	intra-departmental towards inter-departmental	inter-departmental	inter-organisational
Organisational focus	functional oriented towards specialism oriented	Specialism oriented	patient oriented
1. Strategic drivers and incentives for networking	Externally, marketing the hospital and attracting the 'right' patients.	Externally, to reduce costs.	External, improve efficiency and effectiveness of rheumatology services, meet patients' demands, through the exploitation of ICT.
	Internally, efficient and effective use of capacity and competence resulting in cost-reduction.	Internally, to improve efficiency and effectiveness in control resulting in reduced costs without loss of quality in hospital healthcare.	Internally, to formalise effective lines of communication and develop expertise.
2. Enabling conditions for networking	A clear hospital strategy is needed to align the strategic information management with.	Efficient and effective control of hospital organisations depends on ability to determine the relation between input and output These changes demand a higher flexibility of ICT.	The demand and supply mechanisms regarding rheumatology knowledge and ICT knowledge across the network. Sharing of costs (i.e. technical infrastructure) and risks (i.e. privacy).
3. Design of the network organisation	There is only one clear transmurial example in which ICT plays a dominant role. However it is based on bilateral agreements (two nodes) and unidirectional data flow that is not integrated with the other information systems (low reach and range).	In seeking improved efficiency and effectiveness, a reorganisation took place to evolve from an intra-departmental to a inter-departmental organisation structure. Units (9 Care Units, 8 Supporting Care Units and 2 Service Units) were introduced to give the middle management the flexibility needed (moderate range and reach).	Separate responsibilities for rheumatology services and ICT services. Different functional roles and levels: 'sponsor', 'network co-ordinator', 'participants/users'. Enabling role of multimedia network technology (high reach and range).
4. Functioning of the network organisation	Mainly the ICT department and the administrative department are involved in the organisation and management of ICT. Technical support, implementation and central computing facilities are mostly insourced. The budget for innovation has been big.	Hospital middle management, functional operators and physicians and automation co-ordinator are involved in the organisation and management of ICT. Technical support, implementation and central computing facilities are outsourced. The budget for innovation is small.	Network and stakeholder management. Provision of telerheumatology services across the network. Leveraging of rheumatology expertise across the network. Centralised (concentrated) ICT infrastructure and dispersed ICT applications Differentiated demand and supply of multimedia network technology.
5. ICT infrastructure of the network organisation	The implementation of a new hospital information (SAP R3) system, based on new technology makes future networking possible.	To support the specific hospital processes mainly HISCOM (market leader) information systems are used.	A multimedia database -'the post office'- based on internet technology is used to facilitate communication and diagnosis of rheumatology cases. Critical requirements are a-synchronous multimedia communication.
6. Performance of the network organisation	The lack of a clear hospital strategy provides no triggers to reach beyond organisational boundaries in transmurial care projects. There is no clear measure for performance.	Reduced costs without loss of quality in hospital healthcare. In this way a contribution is made to the mission statement. The networking is starting to reach beyond organisational boundaries in transmurial care projects.	Improvement of inter-institutional collaboration and communication. Efficiency and effectiveness improvement of rheumatology services. Stakeholder satisfaction Redefinition of stakeholder roles and (strategic) positioning in the sector.

Table 1. Interpretation of key findings in the three cases, structured according to the model in Figure 1

'collaborative advantage' of working together, sharing knowledge and developing expertise.

The stakeholders indicate that they are satisfied with the multimedia database application as it fits their needs to conduct asynchronous rheumatology diagnosis. Because of the networking endeavours, RRD is rethinking its strategic position in the sector and looking into a new role of ICT vendor and consultant as an 'ICT Health Intermediary'.

4. Network Organisations in Hospitals and Stakeholder Roles.

To summarise the findings in the three hospitals, the Leipzig hospital is regarded to be an example of an intra-departmental network organisation, the Bosch

Medicentrum hospital an inter-departmental network organisation, and the Roessingh hospital an inter-organisational network.

Strategic drivers and incentives for the emergence of network organisations in all three hospitals are:

- (i) improvement of efficiency and effectiveness of the primary care process; reduce costs, and;
- (ii) meeting patients' needs and patient-information-streams. Internal and external stakeholders have different 'rationalities' regarding improvement of efficiency and effectiveness.

Enabling conditions for network organisations in hospitals are:

- (i) a clear hospital strategy, aligned with a clear ICT strategy, and;

(ii) an open and flexible hospital information system that can support the transactions of the network.

More specifically with regard to the role of ICT in hospital network organisations, we see that as hospital networks transform from an internally functional-oriented organisation towards an externally patient-oriented organisation, ICT plays an increasing strategic role, thereby shifting from a 'utility', towards a 'dependent' and finally an 'enabling' role. The shift in network design and ICT role has consequences for the different stakeholder roles and the dominant coalitions.

stakeholder expectations and networking agreements. Stakeholder roles are redefined and the performance is assessed in terms of stakeholder satisfaction.

- In a patient oriented structure stakeholder roles have been institutionalised and the 'benefits' of networking become clear. These include: health care efficiency and effectiveness gains, professionalisation and expertise development and stakeholder satisfaction. Performance in financial terms remains difficult because the relations between input and output in a hospital are hard to determine since 'traditional' cost-benefit analyses of network organisations in health care are sub-optimal

	External Stakeholders				Internal Stakeholders				
	Funding institutions	ICT-Vendors and consultants	Patients	Other healthcare institutions	Top Management	ICT department	Physicians and Researchers	Nursing	Administrative
Leipzig (functional-specialism)	-	++	-	-	++	++	-	-	++
Bosch Medicentrum (specialism)	+	+	-	+	+	+	+	-	+
Roessingh (patient)	++	+	+	++	+	++	++	+	-

Table 2. Organisational focus and stakeholder involvement in the organisation and management of ICT

The association between the organisational focus of the three hospitals and the involvement of the internal and external stakeholders in the organisation and management of ICT is described in Table 2. The following observations can be made:

- In a functional oriented hospital classical stakeholders such as the ICT department and administration dominate the use of ICT together with ICT vendors and consultants.
- In a specialism oriented hospital the use of ICT can come to a standstill as a result of the 'over'-participation in the number of stakeholders.
- In a patient oriented hospital internal stakeholders such as physicians, researchers and nurses dominate the use of ICT together with external stakeholders such as the funding institutions, and other healthcare institutions.

As hospital network organisations evolve in network focus and design, the dominant coalitions of stakeholders also evolves and stakeholders assume different roles.

With respect to the performance of network organisations in hospitals it appears that

- In a functional oriented structure that performance is not defined in advance or performance measures are described in general terms, repeating the mission statement.
- In a specialism oriented structure performance is likewise described in general terms, with a focus on

because they fail to account for all the (inter/intra-organisational) changes that occur as a result of networking.

What emerges from the foregoing, is a relative complex and dynamic picture of network foci and designs, and the role of different stakeholders and ICT, in hospital network organisations (Figure 3).

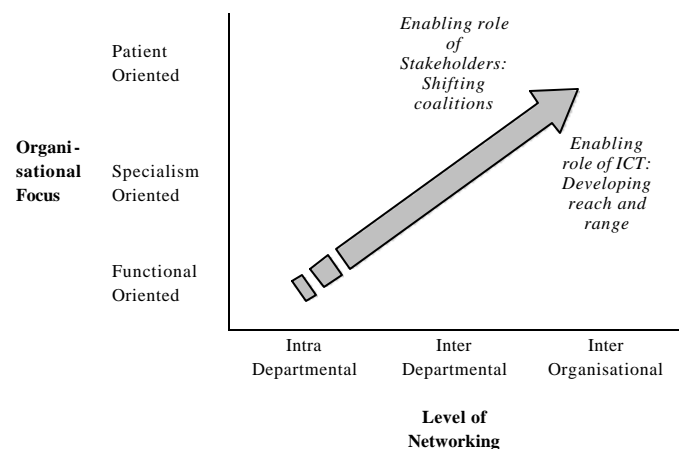


Figure 3. Trends in Hospital Network Organisations

The case studies indicate that when hospital networks transform from internally functional oriented organisations towards externally patient oriented organisations, the complexity of both the social infrastructure the technological infrastructure increase in reach and range. In the case of Roessingh organisation, network formation started in the late 1995, and over the past 5 years, the hospital network has gradually developed from an internally functional network towards an external patient network. The case findings suggest that both social and technological 'webs' need to be considered and managed in order for the hospital network to transform successfully through each of the networkability stages. Critical success factors for sustaining networkability are stakeholder roles and relationships and the ICT reach and range.

5. Conclusions

Two Dutch hospitals (one general and one categorical) and a German hospital (university) were analysed as examples of network organisations in health care. Three levels are distinguished: inter-departmental network, intra-organisational network, and inter-organisational network. In the three cases in this study the three levels corresponded with the organisational focus: respectively functional orientation, specialism orientation, and patient orientation. The case findings indicate that there is no such thing as 'one best' network organisation in hospitals.

Strategic drivers and incentives are improvement of efficiency and effectiveness of the primary care process. Enabling conditions are a clear hospital strategy and an open and flexible hospital information system that can support the transactions of the network.

The design and functioning is influenced by the not-for-profit market the organisational focus and the involvement of internal and external stakeholders. The role of stakeholder groups with regard to the organisation and management of ICT varies between the different organisational foci. In the functional oriented hospital the impact of ICT vendors and consultants is very high, the role of patients, physicians, researchers and nurses low. In contrast, in the patient oriented hospital, the impact of ICT vendors and consultants appears to be low, while physicians, researchers and nurses, funding institutions, and other healthcare institutions are high. However, in the case of the Rheuma network, RRD fulfilled the role of an 'internal' ICT vendor and consultant. More research is necessary to investigate what roles (internal and external) ICT vendors and consultants play in ICT-enabled network hospital organisations.

With respect to the network structure in hospitals and the stakeholder model, the findings in the three cases suggest, that hospital networks transform from an internally functional-oriented organisation towards an externally patient-oriented organisation. In this process, ICT plays an increasing strategic role, thereby shifting from a 'utility', towards a 'dependent' and finally an 'enabling' role. The shift in network design and ICT role has consequences for the different stakeholder roles and the dominant coalitions. Eventually, the move to an external orientation will lead to a restructuring of the healthcare sector, as was the case the Rheuma network.

The measurability of performance seems to improve as the level of networking evolves from inter-departmental to intra-organisational. However, performance expressed as financial performance will remain difficult to measure, because the relation between input and output in a hospital is hard to determine, but also because network performance involves complex inter-organisational changes, that cannot be expressed in financial terms only.

The findings and conclusions in this paper are based on in-depth analysis of three cases. More cases need to be investigated before generalisations can be made. Moreover, future research should specifically focus on the development of social and ICT networks that enable health care organisations improve networkability and performance. Comparisons with network organisations in other sectors and lines of industry is likewise necessary and useful, in order to develop guidelines for the organisation, management and use of ICT, to enable effective, efficient and high quality organisational forms in health care.

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Appendix A: Dimensions and descriptions of the research model for network organisations

Dimension	Description	Sample Question
1. Strategic drivers and incentives for networking	The objectives, motives, perceptions and expectations of organisations and stakeholders involved in the network.	What are the business and ICT drivers for networking and how are these perceived by the nodes in the network?
2. Enabling conditions for networking	The conditions that enabled or stimulated the emergence and formation of the network.	What are the critical organisational and managerial conditions and capabilities for networking?
3. Design of the network organisation	The structuring of the network responsibilities, decision-making units, and coordination mechanisms.	What organisations are involved in the network, with what functions, tasks and responsibilities?
4. Functioning of the network organisation	The inter- and intra-organisational processes and (transactional, informational) activities.	What are the primary (core) processes in the network and what is the role of ICT?
5. ICT infrastructure of the network organisation	The ICT infrastructure of the network.	Which standards are used? What is the position of legacy systems? How is data quality ensured?
6. Performance of the network organisation	Impacts and effects (unexpected) of the network.	When is networking (perceived) as successful, and how are the impacts shared across the network?