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Abstract

The health care sector is characterised by a low division of labour and annually rising costs. In order to increase effectiveness and efficiency, other sectors have implemented a high division of labour and extensive networking, in particular through the use of IT. In the health care sector, however, networking is only progressing at a very slow pace and not along a wide front. While initial approaches to networking already exist at the technical level or for the purpose of process optimisation, holistic approaches are missing. In this article, the authors first show how a generic, holistic framework for designing networked structures can be transferred to the health care sector. Then the concept of networkability and its design objects are introduced. In order to assess networkability, the use of development levels for design objects is proposed so that a maturity stage model can be derived on this basis for the various players in the health care sector. Thereafter the results of an expert workshop regarding the main design objects which determine networkability in the health care sector are presented. The article concludes with a description of the procedure for validating and further developing the findings obtained.

Keywords

Network, networkability, eHealth, health care sector

INTRODUCTION

In many industrial nations the health care sector is characterised by annually rising health costs (Herzlinger, 2006). In 2004, for example, the costs in the Swiss health system rose by 5.9%, compared with cost increases of 4.6% in 2003 and 3.6% in 2002 (santésuisse, 2005). Alongside causes such as the ageing population or the lack of economic growth (Prada et al., 2004), this cost problem is attributable to the fact that health care as a commodity is difficult to manage because of its subjectivity and its human dimension. In an effort to combat this, the health care sector is heavily regulated, which means that narrow limits are placed on the freedom of action of the players involved. This in turn leads to a high proportion of state investment and thus to low pressure when it comes to effectiveness and efficiency. In addition to the cost problem just described and the low competition intensity, the health care sector in many countries is characterised by decentralised, uncoordinated competencies (Herzlinger, 2006; Kocher, 2004), monolithic structures with a low division of labour (Undritz, 2004), media discontinuities even within individual medical service providers and inadequate quality management (Verein für Informatik im Gesundheitswesen (VIG), 2005).

In order to address the rising costs of health care while maintaining at least the same quality of treatment, special emphasis will need to be placed on the imperative of operational efficiency. If this is to be implemented, the health care sector will have to undergo a fundamental reorganisation. In other sectors, such as engineering and plant manufacture, transformations of this kind to increase the effectiveness / efficiency of processes (e.g. by lowering costs) have already been implemented to a large extent through a high division of labour between market players and extensive networking (Sokolovsky, 2005). Service networks have been created which enable higher efficiency on the part of partners and in the sector as a whole through the effects of the division of labour and networking (Müller-Stewens & Lechner, 2003; Picot, Reichwald, & Wigand, 2001). The prerequisites for the proper functioning of these networks are expandable standards (Weitzel, Beimborn, & König, 2006) which are accepted on a broad basis (Fleisch, 2001) and a concentration on core competencies (Sokolovsky, 2005).

This industrialisation can also be observed in areas belonging to the service sector, particularly in financial services (Bullinger, Tombeil, & Ganz, 2005). In the field of banking, the division of labour and networking have led to a specialisation according to products and customer segments (retail banking, investment banking, private

banking, etc.) as well as to a higher division of labour among institutions (customer bank, production bank, transaction bank, etc.). The market players are responsible for differentiated value creation and work together in service networks (Sokolovsky, 2005). Intermediaries use platforms to provide the services which are required at the interfaces between partners, i.e. between their respective services, processes and systems (Winter, 2002).

In this article we argue that the health care sector also requires a transformation in order to reduce costs and thereby increase efficiency. As stated already, other sectors realized efficiency gains by developing a high division of labour and networked structures based on commonly agreed standards. That is why the paper aims to introduce a holistic framework for designing networked structures and to adapt it to the health care sector. Furthermore we aim at introducing the concept of networkability and its development. In order to develop networkability, the use of design objects and levels of development are proposed. On that basis, a maturity stage model can be derived which allows the measurement of networkability of the various players in the health care sector. Finally it is an aim of this article to present first results of our current research project regarding design objects of networkability obtained through an expert workshop conducted in the Swiss health care sector.

In section 2, the role of IT as enabler for the creation of industrial structures is first discussed, i.e. structures characterised by a high division of labour and networking. The extent to which the approaches to such target structures in the health care sector (eHealth) are already having an effect is also discussed. In section 3, a framework is presented which has been used with great success in other sectors for the systematic design of networked, operationally efficient structures. The adaptation of this framework to the health care sector is described in section 4. An attempt is made to follow on from existing and future eHealth approaches. Networkability is recognised here as the key factor. In section 5, the concept of networkability and its development are introduced. Furthermore we present essential design objects identified at an expert workshop. The article concludes with a description of the procedure for validating and further developing the findings obtained.

IT AS ENABLER FOR TRANSFORMATION OF THE HEALTH CARE SECTOR

It is in the service sector in particular that the use of IT plays a central role for the division of labour and networking (Berensmann, 2005). The great importance of the use of information and communications technologies as a means of realising transformation has been recognised not only in the private sector but also in public administration (Schedler, 2000; Schedler & Summermatter, 2002). The term “eGovernment” has established itself in public administrations. By analogy, the term “eHealth” has been coined in the health care sector, while as yet no common understanding of this concept exists. As long ago as 2001, Eysenbach defined eHealth as “an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology“ (Eysenbach, 2001). The Swiss Association for IT in the Health Care Sector (*Verein für Informatik im Gesundheitswesen*) has analysed further definitions (e.g. by Dietzel, Baer, etc.) and formulated its own, shorter definition as follows: “Under E-Health we understand the integrated use of information and communications technology (ICT) for the design, support and networking of all processes and players in the health care sector.” (Verein für Informatik im Gesundheitswesen (VIG), 2005). In the case of eHealth, efforts are mainly concentrated on information systems. Authors and projects are involved amongst others with telemedicine, application integration, the standardisation of data formats and in particular digital patient records, data security, the patient card and basic infrastructures (cf. for example (Schwarze et al., 2005)). At the same time, or building on from here, efficiency increases are aimed at for individual processes. This includes payments between medical service providers and insurers, the communication of diagnoses between medical service providers (doctors or hospitals) or prescriptions between medical service providers and pharmacies (Verein für Informatik im Gesundheitswesen (VIG), 2005). The potentials for efficiency increases through eHealth approaches are enormous (Girosi, Meili, & Scoville, 2005).

In a highly competitive sector, the players would be expected to rapidly adopt approaches of this kind. In the health care sector, however, the adoption of eHealth is only proceeding at a very slow pace and not along a wide front (Fonkych & Taylor, 2005). The large number of players (hospitals, doctors, laboratories, pharmacies, insurance companies, suppliers) and their different interests, interdependencies and a lack of transparency in the competitive situation as well as local powers of authority in many cases make it difficult to articulate common goals for the transformation process (Herzlinger, 2006), which frequently becomes a battle for financial resources (Schweizerische Gesellschaft für Allgemeinmedizin (SGAM), 2006), and to plan and control this process. The problems outlined here often manifest themselves, e.g. in Switzerland, in the fact that up to now no investor - and neither the federal government nor the cantons - has been willing to take on the project of networking the entire Swiss health system. Standing in the way of a comprehensively coordinated approach are the level of investment per se as well as the uncertainty that the investor will be able to reap either a reasonable return or competitive

advantage as an early participant in a comprehensive network - due to the lack of clarity regarding future regulation or control at federal level.

Before introducing a generic concept for the holistic design of networked structures in the next chapter, the terms network and networkability will be defined. We define network as a collaboration of different business partners that allow them to share data, to exchange documents or to simply communicate (Weitzel et al., 2006). The concept of networkability denotes the ability that (internal or external) business relationships can rapidly be built up and adapted with low setup costs (Österle, Fleisch, & Alt, 2002). Networkability – in contrast to networking in the form of 1:1 interfaces – requires the capability for m:n networking.

GENERIC CONCEPT FOR THE HOLISTIC DESIGN OF NETWORKED STRUCTURES

It is possible to draw on various approaches for the design of networked structures on the path to industrialisation of the health care sector. Müller-Stewens and Lechner, for example, deal with the strategic aspects of networking. They focus on the question of which value creation activities have to be run jointly - in other words in a network - in order to be able to make maximum use of existing synergy potentials (Müller-Stewens & Lechner, 2003). Fleisch also looks at the strategic aspects of networking, but places the emphasis on the process view by analysing the business processes in networked enterprises (Fleisch, 2001). Alongside these strategic and process-oriented approaches, many authors frequently concentrate primarily on the design of networked information systems or IT platforms (Frießem, Kalmring, & Reichelt, 2005; Lenz, Beyer, Meiler, Jablonski, & Kuhn, 2005; Schwarze et al., 2005). Unlike the approaches presented up to now, Österle and Winter recognised that a holistic approach is necessary if networked structures are to be successfully implemented on all layers of analysis (strategy, organisation/processes and information systems/IT platforms) (Österle & Winter, 2003). However, in addition to the necessity for a holistic approach, they take the view that a systematic, engineering-based procedure is indispensable in order to make networking projects of this magnitude and complexity transparent, comprehensible and manageable. The 'Business Engineering Framework' presented in (Österle & Winter, 2003) supports the design of networked structures from the transformation of corporate structures, inter-company relationships, corporate cultures and power structures as well as the redesign of organisational processes and structures to the implementation of IT innovations in the form of new and/or modified information systems and IT platforms. Within the area of business engineering there are now a large number of procedure models and reference models available which are mutually compatible thanks to the common framework on which they are based and their clearly defined terminology and which cover all major design aspects. Figure 1 shows the business engineering framework:

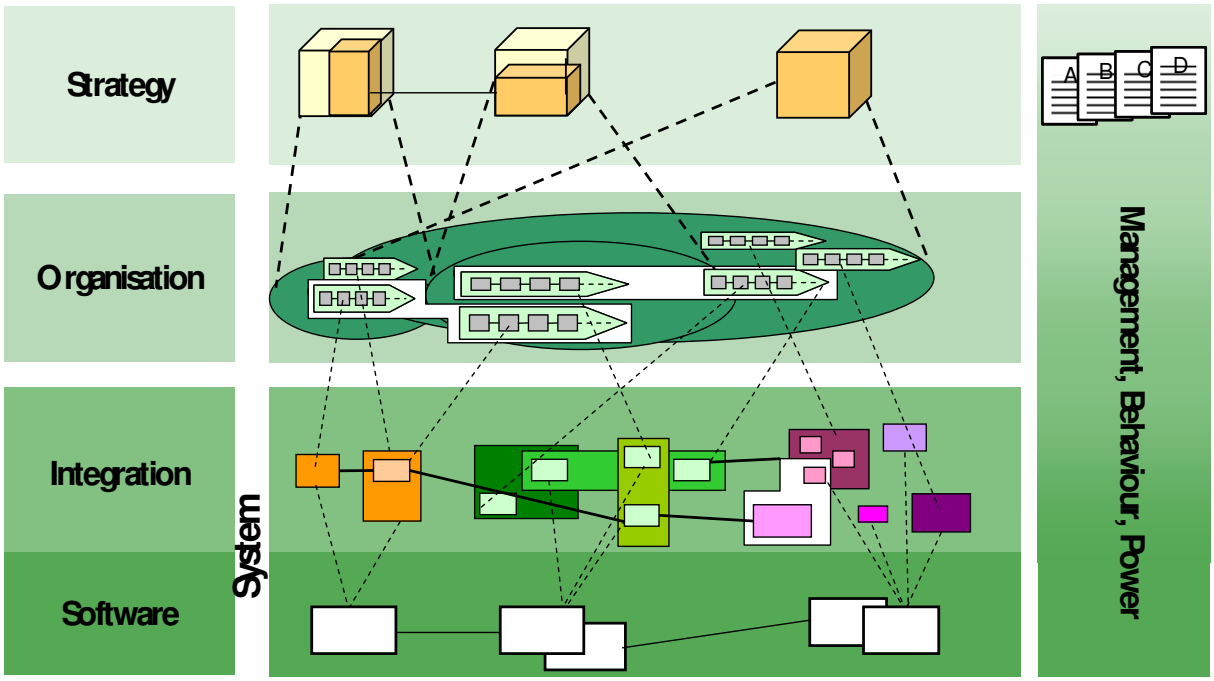

Figure 1: The Business Engineering Framework (after (Winter, 2003))

In the context of networking, the aim is to create connections between the players within a sector on the layers shown above, i.e. on the strategy layer to seek collaboration strategies, on the organisation layer to define

collaborative processes, on the system layer to achieve compatibility between applications and jointly defined interfaces, and to create a culture of collaboration on all layers (management, behaviour, power layer).

Whereas bilateral agreement and coordination is possible on various layers in the case of two partners (1:1 relationship), networking becomes inefficient with an increasing number of partners who wish to cooperate (m:n relationship). An integration system can take the place of progressively increasing bilateral relationships. Networking no longer takes place bilaterally but via a hub, referred to as a "Business Collaboration Infrastructure" (BCI). The BCI consists of binding agreements for partnerships on the strategy layer, a shared vision of the organisation architecture and jointly agreed process interfaces on the organisation layer, and integratable applications, clear semantics for data and standardised information technology on the system layer (Österle et al., 2002). Of great importance on all layers of the BCI is the will to collaborate.

Once networked by a BCI, the players can in some cases take on new roles through the division of labour and specialisation. The following positioning types are available for the generic design of roles (Winter, 2002):

- The Service Integrator is strongly oriented towards services for the end customers, combines purchased services (and may no longer have any actual "production" of its own); its success resides in knowledge of the end customer and its concentration on the end customer.
- The Shared Service Provider is concerned with bulk business; its success is determined by the ability to cope with standardisation, quality and costs.
- The Exclusive Service Provider is a specialist in certain services; it requires specific process competencies, speed and flexibility to be successful.
- The Public Service Provider makes basic services available which serve the interaction between other roles (amongst others, certification, authentication, information services, payment handling, logistics, outsourcing); it needs a critical mass of customers to be successful.

ADAPTATION TO THE HEALTH CARE SECTOR

The business engineering framework provides models, methods and techniques for the transformation of traditional industry structures. The following section shows how the business engineering framework can be transferred to the health care sector in order to drive forward networking between the players.

In view of the importance of the underlying regulatory framework in the health care sector, the business engineering framework was extended to include the aspect "regulatory framework" (cf. Figure 2).

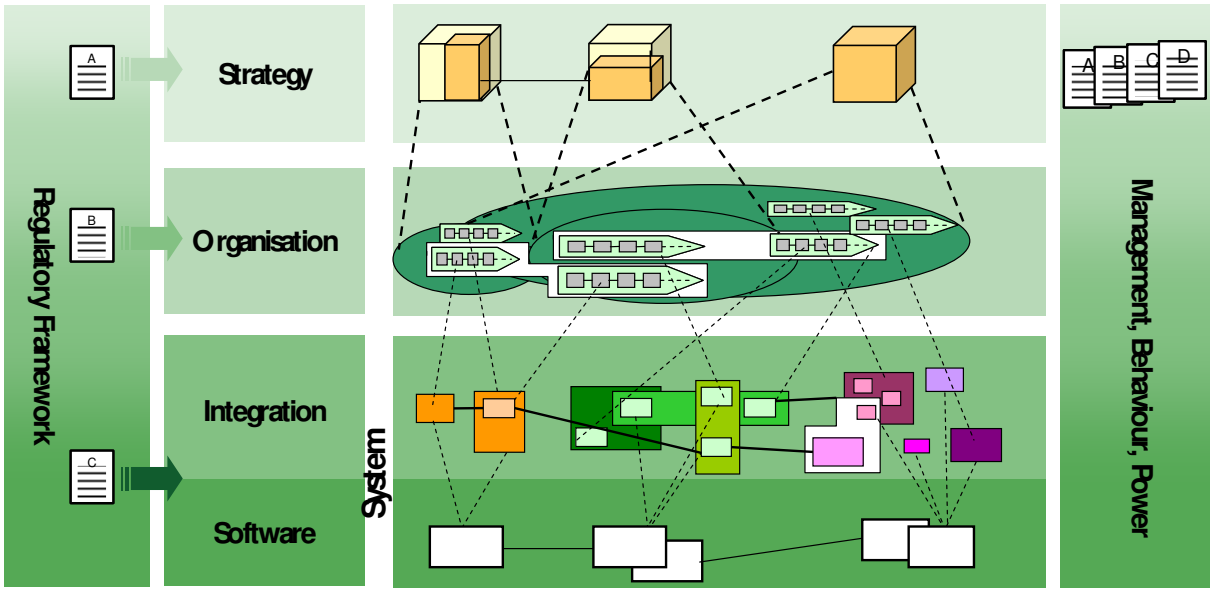

Figure 2: Extended Business Engineering Framework

In the Swiss health care system, for example, this involves the following:

- On the strategy layer: Health-related legislation at federal level (primarily the Health Insurance Act and the Accident Insurance Act); demographics, patient individualisation and mobility; federalism, predominant responsibility of the cantons and requirements for intercantonal cooperation.

- On the organisation/process layer: Charges with TARMED (system of charges for individual services for doctors, hospitals, health insurance providers, etc.).
- On the system layer: Format and classification standards such as e.g. HL7 (Health Level Seven), ICD (International Classification of Diseases), etc.

For the assessment of possible networking scenarios, variants for collaboration strategies and collaborative processes were considered. Possible collaboration strategies included: partnership between medical service providers (regionalisation, specialisation, etc.), partnership between medical service providers and insurance companies, partnership between medical service providers and suppliers, the role of the intermediary, the use of shared services and outsourcing. The required collaborative processes are price quotation, coverage check, billing, information flow (diagnosis, medication, etc.), resource planning (division of labour and distribution of workload), knowledge sharing, logistics, supply chain management, finance, IT, catalogue maintenance (master data, etc.) and directory management.

As a fundamental principle, networking in the health care sector can be achieved either through an integrated system ("total networking") or through the design and operation of interfaces. Cost curves exist for both approaches (cf. Figure 3):

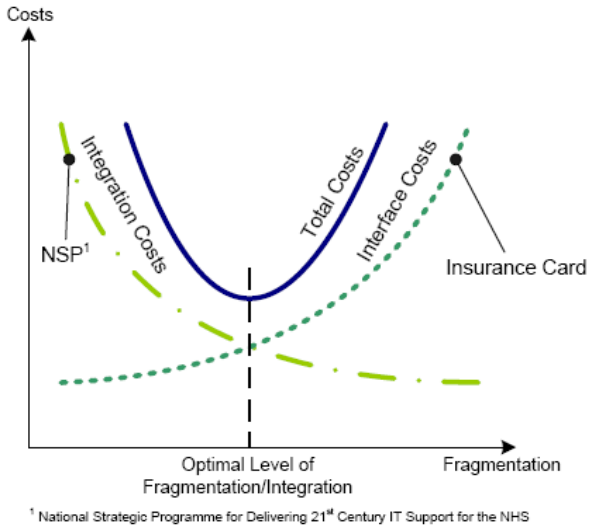

Figure 3: Costs of Integration and Interfaces (Source: (Winter, 2006))

With the first variant, **"total networking"**, costs increase with the reduction in the number of differently structured participants, i.e. with decreasing fragmentation (dot-dashed line). An example of this variant is the British "National Strategic Programme for Delivering 21st Century IT Support for the NHS" (Department of Health (DH), 2006). With the second variant, **"interfaces"**, costs increase as the number of differently structured participants grows, i.e. with increasing fragmentation (finely dashed line). This variant corresponds to the approach for the insurance card planned in Switzerland (Bundesamt für Gesundheit (BAG), 2005).

Both cost curves have an overall cost development where the minimum indicates the optimal level of fragmentation / integration. To achieve this, an appropriate degree of "**networkability**" is required. The term networkability is – as stated already – understood to mean that the (internal or external) business relationships can rapidly be built up and changed with low setup costs (Österle et al., 2002). Networkability – in contrast with networking in the form of many 1:1 interfaces – is the capability for m:n networking. The main building blocks of networkability are a BCI (cf. above) and the appropriate business services which are jointly accepted by all players involved. The business services required in the health care sector include amongst others patient information logistics, patient relationship management, financial clearing, prescription workflow, medical correspondence workflow, resource planning, treatment planning, diagnosis support, portals, shared services (amongst others for logistics, SCM, finance, IT), catalogue, directory and meta directory (authentication, authorisation), as well as card services.

INCREASING NETWORKABILITY

In the previous section the concept of networkability was introduced and applied to the health care sector. In the following section a procedure is described which can be used for comprehensively recording the networkability of the various players in the health care sector and for developing it in a structured manner. The first step for systematically designing networkability is to identify the various aspects and/or design objects of networkability

(Österle et al., 2002). For each of these individual design objects, the respective levels of development are then defined along with the performance indicators for their classification (cf. Figure 4). In this context, it is not necessary for all design objects to have the same number of development levels. The definition of development levels is necessary in order to enable targeted networkability development by measuring and evaluating the design objects (Österle et al., 2002).

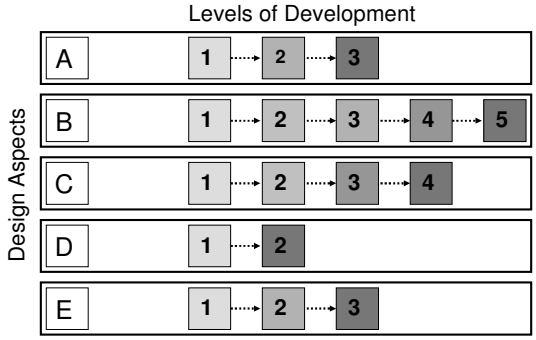

Figure 4: Design Objects of Networkability and their Levels of Development

Finally, the individual maturity stages are defined (cf. for example (Ahlemann, Schroeder, & Teuteberg, 2005)). This is done by defining a specific combination of development levels of all design objects for one maturity stage. Thus, for example, a maturity stage 2 might stipulate that the design objects A to C must have reached development level 2, while objects D and E only need to have reached development level 1 (cf. Figure 5).

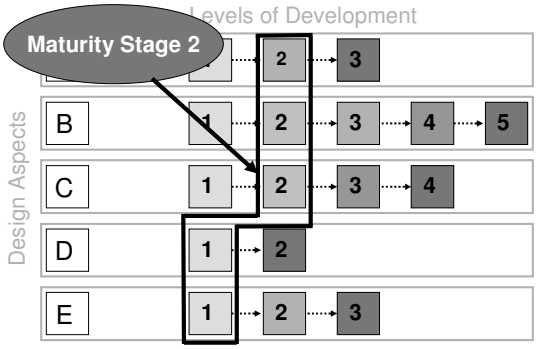

Figure 5: Definition of Maturity Stages

The thus defined maturity stages

- allow a player's level of development to be recorded,
- support the definition of networking goals,
- allow the time and effort required to integrate new partners into a network to be estimated,
- allow the progress of networking projects to be monitored and
- enable benchmarking to be performed between different players.

Within a research project, work began on implementing the procedure just described based on the example of the Swiss health system. First of all, an explorative workshop was held with various players. These included five representatives from hospitals and clinics (medical service providers), four representatives from insurance companies and four representatives from suppliers. The goal of this workshop was to identify the design objects of networkability from the viewpoint of the respective players. At the beginning of the workshop, the group was divided into three sub-groups: hospitals, insurance companies and suppliers. In each group, design objects of networkability in the health care sector were identified using brainstorming techniques. Thereafter each group tried to position the identified design objects in the extended business engineering framework (cf. Figure 2). Finally the experts in each group were asked to analyse their design objects regarding aggregation and specialisation. After finishing the work in these sub-groups, the final results were discussed in the complete group. The results of the workshop are shown in Table 1:

Layer	Hospitals/Clinics	Insurance Companies	Suppliers
Strategy	- Collaboration strategy - Business-IT alignment	- Shared network vision - Clarity of role - Knowledge of synergy effects - Divisibility of services - Standardisation of market services	- Networking motivation - Intercantonal integration
Organisation	- Exchange of knowledge in (IT) committees - Project and application portfolio - Process and quality assurance - Integration of IT and organisation	- Network planning and control - Isolatability of processes - Transparency of processes - Distribution of responsibility / control - Standardisation of process outputs - Organisation character (function vs. process)	- Business hub - Incentive system
System (Integration and Software)	- Standards - Electronic Patient Records (EPR) - Service Level Agreements (SLA) - Enterprise Application Integration (EAI) - Data protection during exchange	- Standards - Isolatability of services - Information flows between applications - Integration architecture - Access rights / security	- Standards - Harmonised architecture
Management, Behaviour, Power	- Incentive system - Patient awareness of managed care - Awareness of information security	- Team and communication capability - Transformation capability - Customer orientation	- Corporate culture - (Small) number of standardisation committees
Regulatory Framework	- Provisions in the service mission regarding collaboration		- Political framework → influence on public opinion

Table 1: Design Objects of Networkability from the Viewpoint of the Various Players

The findings from the workshop shown in Table 1 illustrate the fact that, in addition to design objects which are only identified by a single player, aspects of networkability also exist which are important for several players in the health care sector. Thus, for example, on the strategy layer a shared network vision and/or collaboration strategy plays an important role for all the players analysed (hospitals/clinics, insurance companies and suppliers) for the design of networkability. This also applies for design objects such as standards, a harmonised integration architecture and security on the system layer. It is also clear from the table that the business engineering framework, extended to include the aspect of the regulatory framework, is suitable for classifying the design objects since design objects could be found on all layers of the framework and it was possible to assign all design objects found to the layers.

These initial findings provide the starting point for identifying other design objects of networkability in the health care sector. For this purpose, it would be appropriate to consider which design objects involve or presuppose further design objects on other layers. In addition, dependencies and synergy effects between different design objects (between players and/or between layers) will have to be identified. Once all relevant design objects have

been identified, levels of development and maturity stages can be defined which will enable each player to perform a comprehensive assessment and formulate a systematic definition of its path to networkability.

SUMMARY AND OUTLOOK

In this article it was argued that the health care sector requires industrialisation in order to satisfy the imperative of operational efficiency. It was explained that the various approaches from the area of eHealth which are oriented towards the stated goal require a holistic and methodological framework for the design processes to manage the transformation. At the generic level, business engineering for networked structures represents an approach of this kind. Initial research work suggests that a path has been found which can be adapted for the health care sector. The search for design objects for networkability has given rise to initial findings. During the course of our research project, as outlined at the end of the above section, these will be further developed and above all validated. For this purpose we shall

- survey a sufficiently large number of insurance companies, hospitals and suppliers with a view to testing the design objects and their levels of development with regard to validity, completeness and consistency,
- conduct workshops with selected players in order to investigate the levels of development with regard to their measurability and classification suitability, and
- in order to classify the respective design objects with their levels of development in maturity stages.
- If the applicability hypothesis is validated, the approach must be broadened to include further players and a wider focus above and beyond designing networkability. The ultimate result should be clear recommendations in the form of reference models and maturity stage models.

At the same time, the design of service missions and the creation of incentives will play a key role as the prerequisites for the implementability of these models. In addition to the target business structures including the respective incentive systems it will nonetheless be necessary to take into account the fact that "soft" factors, such as e.g. the ability and willingness to change, will play a very significant role for the transformation process in the health care sector, and will probably be far more important than "hard" factors. A systematic, business-oriented construction method for creating more operationally efficient structures must therefore be supplemented by an appropriate change management concept. Initial approaches which are compatible with our own are to be found e.g. in (Gericke & Winter, 2006).

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