Business Models for eHealth

Final Report

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Preface

This document contains the final report on a project funded by ICT for the Health Unit, Directorate General Information Society and Media, European Commission. The project explores the intricacies of business models for value-creating and sustainable eHealth systems. It concludes with a set of strategic operational guidelines and policy recommendations targeted at the European Commission and other European institutions aimed at fostering the development of value-creating and sustainable eHealth services in Europe.

This final report brings together the findings of three interim reports and two expert workshops organised in Brussels in July and November 2009.

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Executive summary

This report presents the analysis of a study funded by the ICT for Health Unit of DG Information Society and Media to explore business models for the implementation of value-creating and sustainable eHealth systems in Europe. It also introduces a set of policy recommendations for the European Commission and other stakeholders, with the ultimate objectives being:

- improvement of the overall quality and efficiency of provision of health services in general via eHealth services, taking into consideration the present and future socio-economic and financial challenges faced by national healthcare authorities in Europe;
- consolidation of eHealth services as a mature market where European industry can play a leading role via the provision of innovative technological and organisational solutions.

The first objective refers to the use of eHealth services and solutions to improve overall healthcare delivery. As argued in the opening stages of the report, these information technology (IT)-enhanced healthcare services can support healthcare delivery organisations and health authorities to provide responses to factors such as Europe's ageing population, the growing prominence of chronic diseases and financial challenges in controlling overall healthcare spending. The second objective refers to the fact that eHealth services and solutions can provide the appropriate responses previously indicated if industry delivers the appropriate technological solutions. Actually, as argued in the report, eHealth represents a substantial market where European industrial players can have a pivotal role.

Nevertheless, the achievement of these two objectives is not an automatic process. eHealth services need to deliver on their operational and strategic objectives by providing value and sustainability. In the context of this report, the term 'value' is used to identify an eHealth service whose functionalities bring socio-economic and healthcare value to patients and/or healthcare professionals. These involve specific elements such as better clinical care, safety, timeliness of care, quality, effectiveness and efficiency. The expression 'sustainability' defines an eHealth system which has passed the pilot phase and is fully operational to provide data for assessing its overall performance in line with a set of predefined benchmarks and indicators. As argued in the report, value creation and sustainability require eHealth services to be supported by business models reflecting the interests of all the involved stakeholders. More importantly, these business models need to detail the interactions and interdependencies among all of the stakeholders and how the introduction of an IT service is going to affect them.

Therefore, the report looks at the challenges of devising these business models for value-creating and sustainable eHealth services. It provides a set of operational guidelines for overcoming them. It also looks at the public policies required for establishing the right conditions for devising these business models, so as to allow Europe to collect the social and economic benefits of eHealth and to consolidate a commercial market where Europe's industry can play a leading role.

Approach

This study has applied a number of research approaches in a sequential manner. First, it has undertaken an illustrative literature review and semi-structured interviews with pan-European experts in the field of eHealth. Second, it has examined five illustrative case studies of value-creating and sustainable eHealth systems in Europe. Each case study falls within one of the four market categories identified by the eHealth Lead Market Initiative, as described in the next table.

Table 1 Lead Market Initiative – market sectors

Market	Description	Case study
Clinical Information System (CIS)	(a) Specialised tools for health professionals within healthcare institutions (e.g. hospitals). Examples are radiology information systems, nursing information systems, medical imaging, computer-assisted diagnosis, surgery training and planning systems; (b) Tools for primary care and/or for outside care institutions, such as general practitioner and pharmacy information systems.	Telemedescape
Secondary Usage Non-clinical Systems (SUNCS)	This category includes: (a) systems for health education and health promotion of patients/citizens, such as health portals or online health information services; (b) specialised systems for researchers and public health data collection and analysis, such as biostatistical programs for infectious diseases, drug development and outcomes analysis; (c) support systems, such as supply chain management, scheduling systems, billing systems, administrative and management systems, which support clinical processes but are not used directly by patients or healthcare professionals.	Centro Unico di Prenotazione Umbria
Telemedicine	Personalised health systems and services, such as disease management services, remote patient monitoring (e.g. at home), teleconsultation, telecare, telemedicine and teleradiology.	Tactive/University City London Hospital (UCLH)
Integrated Health ClinicalInformation Network	Distributed electronic health record systems and associated services such as e-prescriptions or e-referrals.	Naviva

Additional evidence was collected during a final workshop, where experts were invited to provide opinions and ideas about public policy initiatives aimed at supporting the use of appropriate business models for value-creating and sustainable eHealth systems at the national and pan-European levels. (Details of the overall project methodology are available in the annexes.)

Devising business models for value-creating and sustainable eHealth services

The evidence suggests that a solid business model is required for developing and implementing a value-creating and sustainable eHealth service. In particular, this business model needs to map all key supporting activities, value chain relationships and dependencies impacted by the introduction of an eHealth service. This state of affairs can be achieved if a set of activities and steps are implemented.

First, the structuring and implementation of such business model requires strong senior management involvement throughout the various phases of the design, development and delivery of an eHealth service. More importantly, senior management should not just act as a project or programme manager; instead, it should make sure that the eHealth system that it is supporting is provided with the required funding throughout its entire development and implementation phases. Essentially, senior management is expected to have a clear vision of what its healthcare delivery organisation wants to achieve with a specific eHealth service and system, and lead the required operational steps.

In addition, staff involvement is essential in designing a business model of an eHealth service. They need to be given the opportunity to understand how the specific service is to change their activity or role, and need to provide evidence for mapping their interactions in order to see how the eHealth service is going to improve or modify them. All of these activities are aimed at making sure that business models do not fall short of reflecting the interactions of those actors who are to use them in their day-to-day professional activities.

A business model of a value-creating and sustainable eHealth system is a static entity. It might change as a consequence of technological and organisational evolution. However, it can evolve following an evaluation aimed at measuring the potential and current impact of the eHealth system. This may require data collection concerning activity, costs and benefits. It also involves the need to apply sensitivity analysis to assess different scenarios through which it is possible to design or modify a business model. Although the literature provides several eHealth evaluation models, their implementation requires strong senior management and process management, since regular performance data needs to be collected and examined in order to assess current performance and estimate future developments.

Policy recommendations for fostering value-creating and sustainable business models for eHealth

In addition to the application of specific operational guidelines, there is a need for public policy actions supporting the development of value-creating business models for eHealth. These require the involvement of all stakeholders, such as national healthcare authorities, health professional associations, healthcare delivery organisations, industry and the research community as well as European perspectives, so as to foster the sharing of applicable best practice and experiences. In particular, the study has identified these specific public policy options targeted to the European Commission, which is invited to act as the coordination actor for :

- launching pilot actions of eHealth-related projects where different business models are tested or simulated using appropriate modelling approaches;
- fostering the sharing of specific best practice for the design of business models for value-creating and sustainable eHealth systems;

- defining benchmarking parameters so as to ensure that individual organisations are able to monitor and compare the way that they develop and implement business models for eHealth;
- supporting the development of best practice for funding and financing individual eHealth systems, via specific incentives such as tax breaks and/or different reimbursement procedures or co-funding mechanisms;
- bringing legal clarity as to facilitate:
    - identification and authentication of professional health staff accessing and using personal health data;
    - safe exchange of medical data across national borders, respecting the need to protect health data and the personal integrity of the patient, and therefore the rights of patients to give a consent to use of their medical data;
- working towards the solution of technical issues and the facilitation of market developments via:
    - interoperability;
    - common medical terminologies and technical standards, in particular for medical data;
    - pre-procurement activities.

Acknowledgements

The authors would like to acknowledge the support and critical contributions from the experts who were involved in the various phases of the projects. We would like to thank our project officers, Michael Palmer and Jaakko Aarnio, for their constructive approach and useful feedback, as well as the Deputy Head of the ICT for Health Unit, Ilias Iakovidis. Finally, Professor Joanna Chataway and Constantjin van Oranje contributed very substantially by their thorough reviews of the document.

CHAPTER 1 Current eHealth policy and commercial environment in Europe: an overview

Information plays a key role in the provision of healthcare. Providers such as hospitals and doctors generate and process information as they attend to patients. At the same time, patients themselves create, access, process and exchange information about their health situation. Health-related information and communication technologies (ICTs) can play a significant role in the overall management of this data in terms of potential gains in efficiency, financial savings, quality of care and patient safety. In addition, this use of technology can play a pivotal role in the move towards patient-centric care, an approach aiming at building a treatment regime tailored to the individual patient, with much of this delivered outside the traditional hospital context. In fact, one of the core elements of patient-centric care is medical professionals' ability to interact with individual patients irrespective of their geographical location, cutting the economic and operational costs of face-to-face meetings. This involves the use of distant monitoring devices to be implemented at patients' premises.[1] The same technologies can foster healthy lifestyle approaches, where the focus is not exclusively on curing but also on preventing the development of diseases.

This chapter provides an overview of the current eHealth policy and commercial environment in Europe. It is also the first step for supporting the guiding argument of this report and the project: the socio-economic, commercial and policy aspirations of eHealth can be achieved if individual eHealth systems are supported by value-creating and sustainable business models. In the context of this report, the expression 'value-creating' identifies an eHealth service whose functionalities bring socio-economic and healthcare value to patients. These can involve specific elements such as improvement in clinical care, better patient safety and even increased efficiency and effectiveness. The attribute 'sustainability' defines an eHealth system which has gone beyond the pilot phase.

[1] The core elements of patient-centric healthcare are: identification of a patient's main reason for the visit, their concerns and need for information; integrated understanding of the patient's world, their whole person, emotional needs and life issues; collaborative definition of the problem faced by the patient and agreement on its management; enhancement of prevention and health promotion; continuing relationship between the patient and the doctor (see Smith, M. 'Towards a global definition of patient centred care', *British Medical Journal*, vol. 322, no. 7284, 2001, pp. 444–445). The idea of patient-centric healthcare is clearly discussed in 'The future of healthcare: putting the patient at the centre of care', report prepared by the Economist Intelligence Unit on behalf of Philips, 2007. See also Harknes, J. 'The future of healthcare is patient-centred', in *2050 – A health odyssey: thought provoking ideas for policy making*, report prepared by Health First Europe, pp. 16–20. Although it focuses on the roles and responsibilities of patients when facing eHealth, an interesting perspective is also provided in van der Zeijden, A. 'Patient empowerment through effective eHealth strategies', presentation at Clinical Information Systems and Electronic Records and eHealth, London, September, 2004.

1.1 Setting the EU eHealth policy context

European healthcare systems are the pillars of Europe's social infrastructure. Although they differ in terms of operational and financial structure, they share common goals and priorities such as universality, access to good quality care, equality and solidarity. More importantly, EU states also share common challenges. The first is population ageing with direct impact on the overarching dependency factor and pathological map of Europe. Ageing is changing disease composition, with a rise in chronic diseases.[2] However, these are not only linked to ageing; it is also important to consider the rise of chronic diseases such as, for example, diabetes and cardiovascular conditions, which are directly related to unhealthy behaviour.[3] At the same time, citizens as a whole are getting better information about healthcare issues, indirectly pushing national health systems to provide them with better quality and safety. This access to better information is one of the reasons for support for eHealth and healthy lifestyle approaches, in order to foster a better lifestyle for the prevention of chronic diseases. Nevertheless, these challenges do not come without financial implications, since they affect healthcare resource utilisation and expenditure with direct impact on general funding.

The funding of healthcare among EU Member States varies; however, they all rely on a combination of resource funding, with the majority of funds directly or indirectly controlled by national state administration. Overall, in Europe there are three different methods of healthcare financing. The first is a system centred on public taxation (the Beveridge model). The second focuses on compulsory social insurance (the Bismarck model). The third is based on private finance through voluntary insurance that operates on top of standard social insurance. In addition to these approaches, there are several cost-sharing mechanisms through which patients contribute to healthcare financing. These mechanisms, which are not usually applicable to low-income citizens, involve prescribed pharmaceuticals, specialist visits, inpatient hospital care and dental services.[4] Irrespective of the mechanisms, the evolving socio-economic and cultural environment of European society is leading to a substantial increase in healthcare expenditure. Therefore, in this context, the provision of healthcare services using innovative ICTs is seen to be one of the elements helping the containment of healthcare delivery costs[5] while maintaining the expected levels of quality of care and safety.[6]

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[2] For an interesting overview of the relationship between chronic diseases, ageing and the impact on EU healthcare systems in Europe, see Pomerleau, J., Knai C. and Nolte, E. 'The burden of chronic disease in Europe' in Nolte, E. and McKee, M. *Caring for people with chronic diseases: a health system perspective*, Maidenhead, Open University Press, 2008, pp. 15–43.

[3] An interesting detailed overview of the trends is available in Artman, J. et al., 'State of the art of new ICT-enabled models of healthcare: first interim summary', report prepared in the context of the project Scenarios for ICT-Enabled New Models of Healthcare, on behalf of the JRC Institute for Prospective Studies, June, 2007, pp. 22–28.

[4] Jakubobowski, E. 'Healhcare systems in the EU: a comparative study', working paper prepared for the Directorate General for Research, European Parliament, October, 1998. An overview of health systems of European states (members and non-members of the EU) is compiled by the European Observatory on Health Systems and Policies, available at: http://www.euro.who.int/observatory/Hits/TopPage. For a recent overview of healthcare financing among new EU Member States, see 'Country focus: Eastern and Central Europe', *Healthcare IT Management*, vol. 3, no. 5, 2008, pp. 40–46 (available at: http://www.hitm.eu).

[5] For more information, see Akematsu Y. et al. 'An empirical analysis of the reduction in medical expenditure by e-health users', *Journal of Telemedicine and Telecare*, vol. 15, no. 3, 2009, pp. 109–111.

[6] For a comprehensive overview of safety issues connected to eHealth see Stroetman, V. 'eHealth for Safety: impact of ICT on patient safety and risk management', report prepared for ICT for Health Unit, DG Information Society and Media, European Commission, October, 2007.

The European Commission recognised this pivotal role in its 2004 eHealth Action Plan, where it indicated a set of actions and initiatives to be taken at the EU and national levels.[7] This was confirmed in the 2006 Aho report, 'Creating an Innovative Europe', where the importance of ICTs in tackling specific healthcare challenges was seen as an area of action for European leadership, provided that appropriate policies were developed and legislative obstacles removed.[8] This second report recognised Europe's weaknesses in specific eHealth domains such as infrastructure and clinical information systems. It also indicated the barriers for the development of pan-European eHealth services in Europe.

However, the provision of such pan-European services is not an easy task from operational, technical[9] and legal perspectives.[10] In fact, as expressed by the subsidiarity principle, each EU Member State is responsible for the operational delivery and financial management of healthcare. Still, this conflicts with the possibility of EU citizens being in a position to receive treatment irrespective of their geographic location. In order to overcome these barriers, the European Commission has worked towards the establishment of a common framework on the application of patients' rights in cross-border healthcare. In this context, attention is directed particularly towards providing sufficient clarity on the reimbursement for healthcare provided in other EU Member States, and requirements for high-quality and safe health services, so as to allow European citizens to make informed choices.[11] Nevertheless, mobility is not just related to patients but also healthcare staff, as they are expected to move freely within EU Member States, which is thanks also to the expected mutual recognition of professional qualifications.[12]

The possibility for geographical delocalisation of 'healthcare' provision also requires access to patient data via health record systems based on commonly agreed standards.[13]

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[7] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, 'e-Health: making healthcare better for European citizens: an action plan for a European e-Health Area', SEC(2004)539.

[8] Aho Group 'Creating an innovative Europe', report available at: http://ec.europa.eu/invest-in-research/action/2006_ahogroup_eno.htm

[9] For a comprehensive overview of the state of affairs of eHealth technical standards in Europe, see Empirica, 'ICT standards in the health sector: current situation and prospects', a sectoral e-business watch study, no. 108, July, 2008, available at: http://www.ebusiness-watch.org/studies/special_topics/2007/documents/Special-study_01-2008_ICT_health_standards.pdf (visited March 15, 2009).

[10] For a comprehensive overview of the potential legal barriers to the delivery of a pan-European eHealth system, see Van Doosselaere, C. et al., 'Legally eHealth: putting eHealth in its European legal context;, study report on behalf of DG Information Society and Media, European Commission, March, 2008; Dumortier, J. 'Study on legal framework of interoperable eHealth in Europe: country reports', study prepared for ICT for Health Unit, DG Information Society and Media, European Commission, January, 2009 (draft report).

[11] Communication from the Commission: A community framework on the application of patients' rights in cross-border healthcare (COM(2008)415 final). Nevertheless, it is important to emphasise that, as of June 2004, European citizens are allowed to access the European Health Insurance Card (EHIC), which provides proof of entitlement to receive necessary emergency medical care in any EU or EFTA Member State; currently, there are more than 170 million EHIC cards distributed in Europe. A future development associated with the card is to foster electronic card reading at healthcare delivery premises. See Nader, N. 'Interstate access to healthcare in Europe: how to make it easier for citizens?', presentation at the EU Ministerial Conference 'eHealth for Individuals, Society and Economy', Prague, February 18–20, 2009.

[12] This process will be simplified following the consolidation of the EU Directive on the recognition of professional qualifications, including in the healthcare domain. See Directive 2005/36/EC of 7 September 2005 on the recognition of professional qualifications.

[13] For an overview of the eHealth related projects funded through Framework Programme (FP) 6, see European Commission, 'eHealth portfolio of projects', prepared by the European Commission, DG Information Society and Media, September, 2007: for FP7 projects, a detailed summary is available at: http://ec.europa.eu/information_society/activities/health/research/index_eno.htm

Supported by the push in EU activities in this area, national member states have focused on fostering the exploitation of eHealth within their national health systems. Almost all EU Member States have put forward eHealth policies, road maps or other relevant documents that are generally consistent with the EU activities and initiatives in the eHealth domain. In addition, they share a similar concept in which ICT-enabled health systems and applications are viewed as pivotal for enhancing the affordability, quality and safety of healthcare for citizens as a whole. [14]

The pivotal role of eHealth for Europe was confirmed at the 2009 EU Ministerial Conference in Prague and by the December 2009 conclusions of the European Council calling for the implementation of safe and efficient healthcare through eHealth. There has been a call for overarching governance structure so as to remove barriers to the development of eHealth in Europe. This last aspect is extremely important, since the socio-economic and policy developments previously indicated have created a large pan-European commercial market for eHealth solutions (as discussed in the following section).

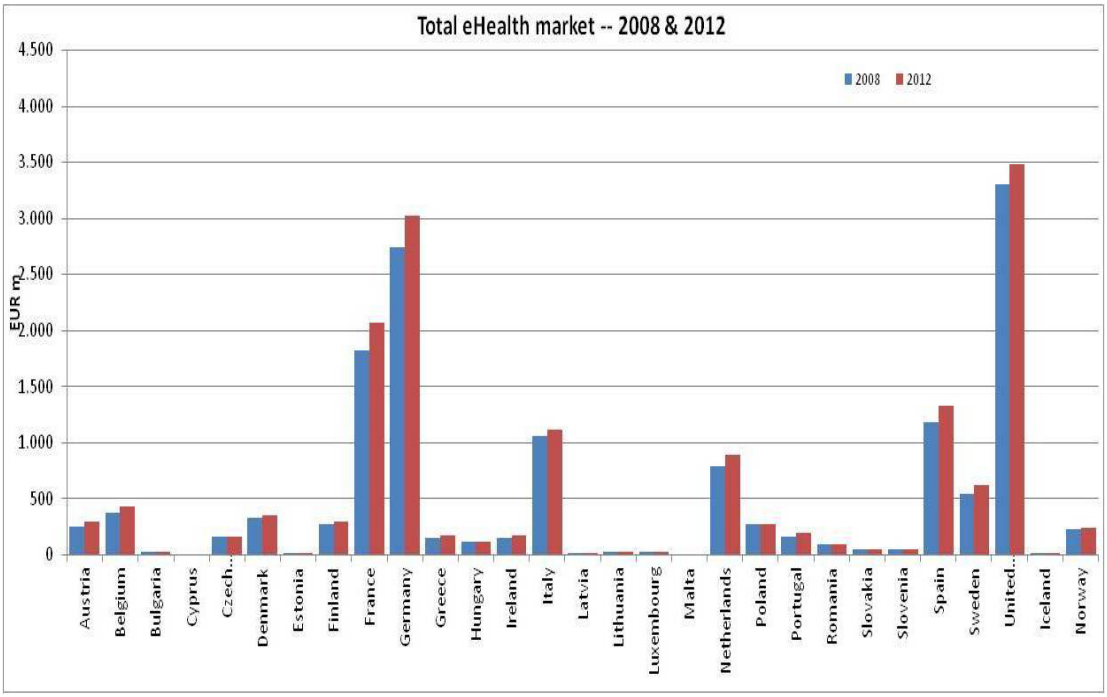
1.2 Current and future market size for eHealth in Europe[15]

The combination of social and policy factors described in the previous section have created the basis for a strong European demand for eHealth services and applications. Based on an analysis undertaken by Capgemini Consulting in the context of this project, the European eHealth market was estimated at EUR14.269 billion in 2008 and is projected to reach EUR15.619 million by 2012, with a compounded annual growth rate of 2.9%. A per-country analysis of the results confirms that France, Germany, Italy, Spain and the United Kingdom are the principal European eHealth markets. However, the analysis also confirms that over the next three years all national eHealth markets will experience some form of growth in this area.

[14] A comprehensive overview is available at 'eHealth ERA report towards the establishment of a European eHealth research area', report prepared by DG Information Society and Health, European Commission, September, 2007. Currently the results of these reports are being updated as part of the project 'Monitoring eHealth strategies', supported by the ICT for Health Unit, DG Information Society and Media (see: http://www.ehealth-strategies.eu/).

[15] The findings of these sections have been extracted from Jansen, P. and Admiral, S. 'eHealth: Market Assessment', deliverable prepared for the European Commission in the context of the current project.

Figure 1 eHealth market 2008-2012



The real difference resides in the current and future market size of the four specific markets identified by the European Lead Market Initiative and is described in the next table.

Table 2 Lead market initiatives: market sectors

Market	Description
Clinical Information System (CIS)	(a) Specialised tools for health professionals within healthcare institutions (e.g. hospitals). Examples are radiology information systems, nursing information systems, medical imaging, computer-assisted diagnosis, surgery training and planning systems; (b) Tools for primary care and/or for outside care institutions, such as general practitioner (GP) and pharmacy information systems.
Secondary Usage Non-clinical Systems (SUNCS)	This category includes: (a) systems for health education and health promotion of patients/citizens, such as health portals or online health information services; (b) specialised systems for researchers and public health data collection and analysis, such as biostatistical programs for infectious diseases, drug development, and outcomes analysis; (c) Support systems such as supply chain management, scheduling systems, billing systems, administrative and management systems, which support clinical processes but are not used directly by patients or healthcare professionals.
Telemedicine	Personalised health systems and services, such as disease management services, remote patient monitoring (e.g. at home), teleconsultation, telecare, telemedicine and teleradiology.
Integrated Health Clinical Information Network (IHCIN)	Distributed electronic health record systems and associated services, such as e-prescriptions or e-referrals.

Capgemini Consulting has concluded that in 2008, Secondary Usage Non-clinical Systems (SUNCS) accounted for 71.6% of the total eHealth market in Europe. Clinical Information Systems (CIS) represented about 13.5% of the total European eHealth market, while Integrated Health Clinical Information Networks (IHCIN) fare at about 5%. Finally, telemedicine accounted for a mere 0.9%. The next table provides an overview of the financial quantification of the four markets.

Table 3 Financial quantification of individual markets in 2008

Composition in 2008 (%)	Final composition (%)
SUNCS	71.60%
IHCIN	5.00%
CIS	22.50%
Telemedicine	0.90%

However, between 2008 and 2012 the situation is to evolve, with a major shift from Secondary Usage Systems to Clinical Information Systems (SUCIS). This suggests that eHealth systems are targeted more towards supporting the operational processes of healthcare professionals. In addition, Capgemini Consulting has identified a growing demand for integrated healthcare clinical information systems in light of an increasing need for data sharing among healthcare delivery organisations. Together with CIS, IHCINs

are expected to be responsible for about 80% of eHealth market growth in the period 2008–2012. More importantly, both segments promise the best prospect for the European eHealth industry in the medium and long term. Finally, the market for telemedicine systems and applications will continue to be small but growing, rapidly suggesting that true adoption of this technology by providers, professional and medical staff as well as patients will take significant time.

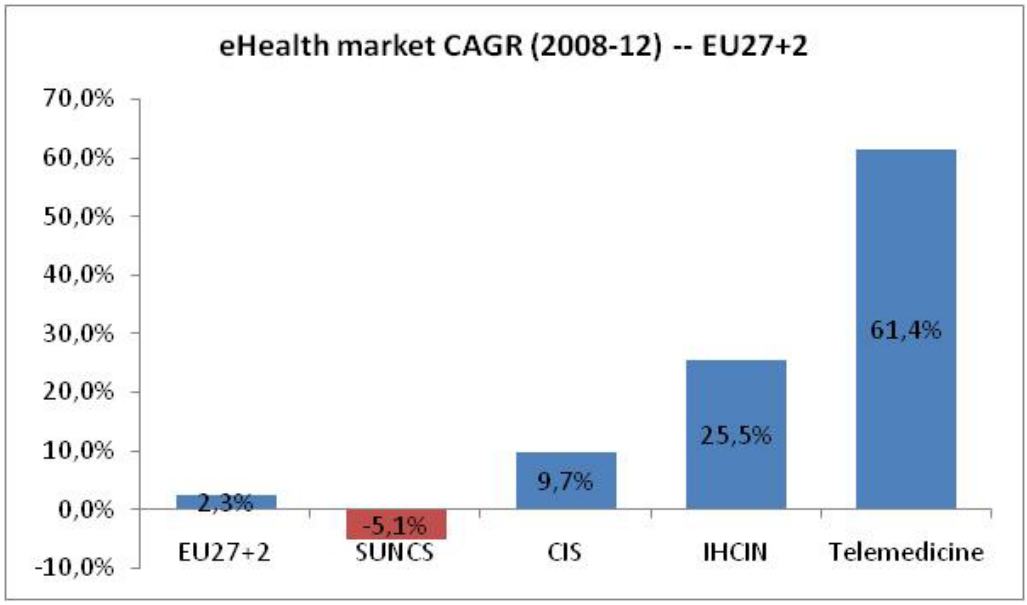


Figure 2 eHealth market compounded annual growth rate (2008–2012) per market sector

These figures confirm what was said at the beginning of this section: eHealth is not just a policy priority for the European institutions or individual Member States; it represents significant commercial opportunity for European industry.

1.3 Concluding remarks

eHealth services can play an important role for the current and current and future delivery challenges to be faced by healthcare services in Europe. They can provide responses to the socio-economic challenges faced by European healthcare systems in the near and long term. Industry is expected to continue to be involved in the development of these services, as eHealth represents a considerable market for European and international industry players. However, in order to tap into this potential, it is necessary for eHealth services to be devised in such a way as to respond directly to the specific operational needs of the healthcare delivery stakeholders towards whom they are targeted. Essentially, eHealth services have to create value for all stakeholders by devising appropriate supporting business models. Failing to do so will just create a situation where healthcare professionals and institutions would lose trust in these solutions and, as a consequence, refrain from exploiting the positive externalities brought about by these eHealth systems and solutions.

CHAPTER 2 Extracting value from eHealth services: evidence from the applicable literature

The previous chapter has provided a snapshot of the overall policy developments and commercial environment of eHealth in Europe. This is an area that continues to provide economic and socio-economic potential, assuming that eHealth systems continue to bring value to their stakeholders. Satisfaction of this condition requires the development of appropriate business models. Still, as argued in the following sections, there is an evident paucity of comprehensive research activities aimed at the identification of business models supporting sustainable and value-generating eHealth applications. The following sections discuss the findings from an illustrative review of recent EU-funded projects and relevant literature sources in the area of business modelling. This effort aims to extract an initial set of guidelines for the development of business models for value-creating eHealth systems. These will be tested using the five illustrative case studies described in the next chapter.

2.1 Value creation in eHealth: an overview of the results of EU-funded projects

The issue of value creation by eHealth systems has been explored in several EU-funded projects. An initial consolidated attempt was undertaken by the European eHealth IMPACT study. Its objective was to devise a generic, adaptable assessment framework for eHealth applications and services focused on the cost–benefit analyses of 10 cases in Europe. Specific effort was made in collecting and analysing the direct and investment costs associated with the development and implementation of each case study, as well as in estimating the expected benefits in terms of quality, access and operational efficiency.[16] The analysis also involved sensitivity analysis of multiple scenarios through different utilisation levels, estimation of annual and cumulative benefits and costs, productivity and distribution of benefits among the various stakeholders. The study concluded that identifying the economic and financial benefits of eHealth needs to take into consideration the overall operational context within which these applications and services lie. More importantly, it indicated the need to go beyond non-financial elements, by considering issues such as change management and organisational adaptation within the healthcare delivery organisation for developing a specific eHealth system or application. Therefore, it concluded that future investors should not expect miracles and 'Big Bang'-type faultiness

[16] For an overview of the full project, see Stroetmann, K.A., Jones, T. Dobrev, A. and Veli, N.O. 'eHealth is worth it: the economic benefits of implemented eHealth solutions at ten European sites', final report prepared for the European Commission, 2006.

from complete eHealth applications, especially in more complex cases where large amounts of data and organisational effort are required. There is always a need for a long-term vision.

A similar argument is substantiated by the US Congressional Budget Office.[17] Building upon the critical analysis of the findings of two US-based endeavours in this domain, it concluded that eHealth systems and applications can lead to financial benefits, provided that a set of non-financial operational conditions are put into place.[18] Still, their adoption has not been as rapid as expected, since the positive financial returns depend on different factors ranging from implementation challenges, evolving legislative and procurement processes to perceptions of the expected positive results among all involved stakeholders, among others.[19]

The complexities of determining the economic and financial returns of eHealth systems, which were identified in the EU-funded eHealth Impact and the US Congressional Budget Office studies, highlight the challenges for the financing of these services especially because of the increasing mismatch between health-related societal trends and available financial resources.[20] The Financing eHealth study has dealt with this topic by discussing different financing models.[21] It opened its analysis with the argument that eHealth financing decisions need to take into consideration the overall 'healthcare value chain' and the actors involved. It is clearly argued that the eHealth systems for which investment is sought have to be interoperable, integrated and interconnected, allowing cross access to data in order to share data, information and knowledge. However, individual stakeholders have their own specific interests in designing and planning eHealth systems, leading to a situation where each type of eHealth investment has a profile of the resources that it requires in terms of type, volume and timing, which in turn determines the required financing arrangements.

Due to the multiplicity of actors and interests, identifying the right supply of financing for the development and implementation of eHealth systems is important. The study

[17] US Congressional Budget Office, 'Evidence of the costs and benefits of health information technology', publication no.2976, May, 2008.

[18] The study examined and criticised the results from the following two studies conducted by the RAND Corporation and Centre for Information Technology Leadership (CITL). The study conducted by the RAND Corporation Health team aimed to quantify US national-level efficiency savings (what results from the ability to perform the same task with fewer resources – money, time, personnel, etc.) brought about by using health information technology (HIT) and comparing them to the costs that the nation has to incur in order to be able to realise those savings. The CITL study instead aimed at quantifying US level efficiency savings brought about HIT and comparing them to the costs that the USA has to incur in order to be able to realise those savings. The focus of this report is primarily on examining the benefits associated with the interoperability of HIT systems. For the results from the RAND report, see Girosi, F. et al., 'Extrapolating evidence of health information technology savings and costs', Report MG-410, 2005, available at: http://www.rand.org/health. The results of the study have also been presented in Hillestad, R. et al. 'Can electronic medical record systems transform health care? Potential health benefits, savings, and costs', *Health Affairs*, vol. 24, no. 5, 2005, pp. 1103–1117. For the CITL, see 'The value of healthcare information exchange and interoperability', 2005, available at: http://www.ctil.org.

[19] This point is also argued in Walker, J, 'The value of health care information exchange and interoperability', *Health Affairs*, vol. 25, no. 6, 2005 (web exclusive, January 19, pp. 5–10).

[20] Although the analysis is limited to electronic health records, this argument is confirmed also in Garrido, T. 'Effect of electronic health records in ambulatory care: retrospective, serial, cross sectional study', *British Medical Journal*, vol. 330, no. 7491, 2005, pp. 581–585.

[21] The final report of this project is available at Dobrev, A. et al. 'Sources of financing and policy recommendations to Member States and the European Commission on boosting eHealth investment', final report, December, 2008.

concluded that, when examining eHealth investments, it is necessary to go beyond the quantification of financial resources. Instead, attention should be directed towards examining those areas of the healthcare delivery organisation which are expected to receive financial support. It is here that the operational benefits and difficulties are located.[22] Therefore, the sustainability and value creation of eHealth investments require that financing should not be directed exclusively towards the coverage of specific direct costs of a new IT solution, but must include 'soft' or 'indirect' elements such as the development of new organisational capabilities to correctly manage the changes brought by introducing the eHealth system.[23]

The Financing eHealth study provided the basis for a more detailed analysis of evaluating the socio-economic impact of electronic health records as part of the Electronic Health Records (EHR) Impact research initiative. The study confirmed the need to examine the issue of effectiveness of eHealth systems using a multidisciplinary approach. In particular, it highlighted different adoption issues affecting the socio-economic impact of eHealth services, such as:

- electronic health records and e-prescription;
- reimbursement mechanisms;
- organisational structures;
- networks;
- connectivity; and
- information governance.

The first issue emphasises that healthcare providers have to consider the potential of having their eHealth service reimbursed, although this may vary according to specific national systems. The second issue refers to the fact that the expected benefits of EHR and e-prescription require strong senior leadership and commitment. The last two factors (networks/interconnectivity and information governance) call for open and technologically neutral solutions when devising eHealth systems, so as to facilitate their present and future integration with other relevant systems. Still, it remains necessary to consider applicable national and international legislative requirements, including those relating to security and privacy. At the end, the strategic objective is to achieve positive network externalities, which state that the value of a specific network grows with the number of actors connected.

As clearly argued in the context of this study, the plurality of elements supporting the adoption of an EHR or e-prescription system emphasises the complexity of devising a comprehensive *ex ante* or *ex post* assessment methodology that embodies the various financial, organisational and technological factors leading to successful implementation of eHealth systems. Actually, it has been argued that this is a paradox, where 'whilst the

[22] This point is also argued in Wang, S. 'A cost–benefit analysis of electronic medical records in primary care', *American Journal of Medicine*, vol. 114, 2003, pp. 397–403 (see in particular pp. 401–402).

[23] The need to look beyond the financial implications when examining the feasibility of an IT system is not just argued within the healthcare research community, but involves the large community examining the value of IT systems within organisations. In this context, interesting works are Ahituv, N.O. 'A systematic approach towards assessing the value of an information system', *MIS Quarterly*, vol. 4, no. 4, 1980, pp. 61–75; Lederer A.L. et al., 'Process and reality in information system benefit analysis', *Information System Journal*, vol. 8, 1998, pp. 145–162; Brynjoolfsson, E. 'Paradox lost: firm-level evidence on the returns to information systems spending', in Willcocks, L.P. (ed.), *Beyond the IT productivity paradox*. London, John Wiley and Sons, 1999.

number of IT applications in healthcare and software programmes is growing (high dissemination), we still have insufficient understanding of how, why, and under what conditions such interventions might work (low evaluation)'. This argument was confirmed at the end of a recent systematic review examining the issue of the value of eHealth. This research endeavour concluded that over the last four years there has been a modest increase in the number of studies examining core factors leading to a successful implementation of health IT systems. Still, this increase has not been matched by a significant rise in research outputs providing in-depth descriptions of the implementation strategy, overall financial context and identification of the facilitators and barriers leading to their full delivery and sustainability, upon which it would be possible to devise generalised approaches or applicable best practice.[24]

It is evident from the previous studies' conclusions that eHealth systems produce value and achieve sustainability when they explicitly take into account socio-technocultural and organisational considerations[25] and the interests of their potential adopters (e.g. patients, physicians, the pharmaceutical industry and hospital administrators).[26]

The previous studies have highlighted the lack of consolidated theoretical approaches for identifying those financial and non-financial elements whose application can allow healthcare stakeholders to extract value from eHealth services. However, the need to identify the value proposition of IT-enabled applications or systems for the delivery of specific services by or within organisations is not just a requirement of the healthcare delivery organisations. Similar topics have been discussed in the growing academic and research literature associated with the concept of business models (as will be discussed briefly in the next section).

2.2 Understanding business models: an overview of the available literature

The term 'business models' was coined initially as a generic term to describe the overall logic of the activities of an organisation. Although this notion appeared for the first time in the academic literature in 1957, its common use began during the 1990s, as did the rise of different definitions.[27] Several authors see business models as the description of key

[24] Southern California Evidence-Based Practice Centre, 'Cost and benefits of health information technology', report prepared for Agency for Healthcare Research and Quality, US Department of Health, AHRQ no. 06/E006, April, 2006.

[25] See for example, Rahimi, B. 'Methods to evaluate health information systems in healthcare settings: a literature review', *Journal of Medical Systems*, vol. 31, 2007, pp. 397–432.

[26] The importance of stakeholders' operational interests reflected in the functionalities of an eHealth system has been strongly emphasised in the evaluation of IT solutions for barcodes, chronic disease management: Agency for Healthcare Research and Quality, 'Inpatient computerised provider order entry', National Resource Center for Health IT, US Department of Health and Human Services. See, in particular, Hook, J, Pearlstein, J, Samarth, A. and Cusack C. 'Using barcode medication administration to improve quality and safety: findings from the AHRQ Health IT Portfolio', AHRQ publication no. 09-0023-EF, December, 2008; Dixon, B.E., Hook, J.M., McGowan, J.J. 'Using telehealth to improve quality and safety: findings from the AHRQ Portfolio', AHRQ publication no. 09-0012-EF, December, 2008; Dixon, B.E. and Zafar, A. Inpatient Computerised Provider Order Entry (CPOE): findings from the AHRQ Portfolio', AHRQ publication no. 09-0031-EF, January, 2009. The publications are available for download at: http://healthit.ahrq.gov (visited April 10, 2009).

[27] An interesting overview is provided in Hedman, J. and Kalling, T. 'The business model concept: theoretical underpinnings and empirical illustrations', *European Journal of Information Systems*, vol. 12, no.1, 2003, pp. 49–59; see also Pateli, A. 'A framework for understanding and analysing eBusiness models', paper presented at 16th Bled eCommerce Conference 'eGlobal' Conference, June 9–11, 2003, available at: http://domino.fov.uni-

components defining a specific business idea.[28] Therefore, their research has focused on examining the interactions within a system of suppliers, distributors, commerce service providers and infrastructure providers.[29] Others prefer to examine the notion of business models by identifying the roles and relationships among a firm's customers, allies and suppliers, major flows of product, information and benefits for all participants.[30] Irrespective of specific differences, these authors consider business models to be the way that an organisation can organise itself so as to extract value to increase its overall financial value.[31]

Irrespective of the different semantic approaches, there seems to be consensus on the core components of a business model:

> The consolidation of a specific set of strategic objectives, the identification of business scope and associated market segment(s) and, finally, the mapping of products, alliances, key supporting activities and value-chain relationships and dependencies to achieve financial value.[32]

This consensus is essential, since it allows the notion of business model to be differentiated from strategy. Business model allows the strategist to consider and reflect on how activities of an organisation work to execute a specific strategy. Therefore, if the strategy refers to the main activities of a firm, then the business model framework helps to create a consistent logical picture of how all of the firm's stakeholders and actors interact to form a strategy.[33] In particular, it aims to map the interactions among all the stakeholders based on their interests,[34] so as a starting point it requires the identification of each stakeholder, its roles and value.[35] By examining the interactions among them, it is possible to obtain results about the performance of a specific business model. Irrespective of its sophistication, this methodological approach is inward-looking, since it focuses on understanding how a specific organisation is expected to extract value from its interactions with all the actors involved in a specific market. Stakeholders outside the firm, such as

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mb.si/proceedings.nsf/Proceedings/4C84233423603AD0C1256EA1002D1A29/$File/25Pateli.pdf (visited March 15, 2009).

[28] Seppanen, M. 'Business model concept: building on resource components', PhD thesis, Tampere University of Technology, 22 August, 2008, p. 3.

[29] This is the approach taken by Alt. R. and Zimmerman, H.D. 'Introduction to special section: business models', *Electronic Markets*, vol. 11, no. 1, 2001, pp. 3–9.

[30] Gordijn, J. 'What's in an Electronic Business Model? Paper presented at Knowledge Engineering and Knowledge Management: Methods, Models, and Tools, 12th International Conference, 2000, available at: http://www.cs.vu.nl/~hans/publications/EKAW2000.pdf (visited March 15, 2009); see also Gordijn, J. et al., 'Business modelling is not process modelling', in *Conceptual modelling for e-business and the web (ECOMO-2000)*, Springer-Verlag, LNCS 1921, Salt Lake City, UT, October 9–12, 2000, pp. 40–51.

[31] This classification is taken from Richardson, J.E. 'The business model: an integrative framework for strategy execution', September 1, 2005, available at SSRN: http://ssrno.com/abstract=932998 (visited March 15, 2009)

[32] For an comprehensive overview of this approach, see Linder, C. and Cantrell, S. 'Changing business models: surveying the landscape', research report, Accenture Institute for Strategic Change, May 24, 2000, available at: http://www.accenture.com/NR/rdonlyres/0DE8F2BE-5522-414C-8E1B-E19CF86D6CBC/0/Surveying_the_Landscape_WP.pdf (visited March 15, 2009).

[33] Magretta, J. 'Why business models matter', *Harvard Business Review*, May, 2002, pp. 86–92.

[34] See Malone, T. et al. 'Do some business models perform better than others', MIT Sloan Working Paper Ma6, 2006, pp. 2–4.

[35] Grasl, O. 'Business model analysis: a multimethod approach' in Dumas, M. and Reichter, M. (eds) Proceedings of Business Process Management, 6th International Conference, BPM 2008, Milan, September 2–4, 2008 (published in *Lecture Notes in Computer Science*, vol. 5240, 2008).

customers or users, are seen as static exogenous factors whose interest is identified in advance.[36] Should the interests of these exogenous actors evolve, there is a need to adapt the underlying business model of an organisation serving their interests through the production of goods and services. Therefore, the dynamic changes of the interactions are limited to stakeholders inside an organisation, such as business managers responsible for specific operations and procedures.

The previous paragraphs demonstrate that the notion of business model is primarily inward-looking and financially focused. Nevertheless, this inward-looking approach provides interesting insights if applied to eHealth. It confirms that the value of eHealth requires that the organisation's stakeholders work together in the same direction and share similar interests and objectives. Therefore, a business model is required to structure and orchestrate these interests, which involves developing appropriate technological tools and implementing supporting processes and procedures that structure the interactions and relationships mapped by a business model.

Finally, the literature has crystallised the difference between strategy and business model. This distinction is extremely useful when applied in an eHealth context. Strategy provides the supporting argument for why a healthcare delivery organisation is to implement a specific eHealth application or system. A business model defines the operational structure of how this eHealth system is to be implemented. The two elements are to be totally linked, since divergences are expected to impact the financial investment on an eHealth system with suboptimal results.

2.3 Linking eHealth to the business model literature

This chapter makes it evident that the identification of potential links between the eHealth literature and literature associated with business modelling is complex. However, this situation should not prevent us from identifying theoretical guidelines supporting the structuring of business models for creating value from eHealth services.

The first key element connecting the literature surveyed is the shared view that the value of business models is not just linked to technology, but to the identification of a supporting business model where stakeholders' interests are represented and all appropriate operational elements are considered:

- customer segmentation;
- value proposition;
- communication and distribution channels;
- customer relationships;
- revenue streams;
- key resources;
- key activities;
- partner network; and

[36] Gordijn, J. 'A design methodology for trust and value exchanges in business models', paper presented at the 16th Bled eCommerce Conference 'eGlobal' Conference, June 9–11, 2003, available at: http://domino.fov.uni-mb.si/proceedings.nsf/Proceedings/B79DB31A6F902FA4C1256EA1002D8C1E/$File/31Gordij.pdf (visited March 15, 2009)

- cost structure.

Still, there are differences in the literature. While in the case of business literature this specific requirement is limited primarily to modelling individuals and activities for extracting value from within an organisation, in the case of eHealth the overall context involves society as a whole. Therefore, when devising a business model for an eHealth system it is necessary to identify the value to be gained by an individual (patient, physicians, nurse, citizens, social security officials, etc).[37]

The exact connotation of this notion of value differs between business models supporting commercial objectives and those associated with eHealth. While in the first case the literature equates value with a pure financial return, in the case of eHealth the overall context varies, as intangible internal and external elements need to be taken into consideration in addition to specific monetary terms. For internal elements, it is possible to consider the specific benefits associated with activities within healthcare delivery organisations, such as a reduction in clinical mistakes, decline in hospitalisation time, enhancement of executive reporting or the improvement of the image of a healthcare delivery organisation, to name but a few. For external elements, it is possible to consider the social benefits, such as a decline in transportation costs and time due to the electronic delivery of a specific cure via telemedicine, or less anxiety and stress for patients.[38]

The starting point is identifying the overarching business strategy of the specific healthcare delivery organisation associated with introducing an eHealth service. This needs to consider the broader healthcare environment within which the organisation operates, and requires identifying and modelling specific socio-economic, funding and regulatory drivers and influences. The starting point is the precise identification of the 'as-is' organisational model that the proposed eHealth system is set to serve. This activity involves developing an agreed understanding of the capabilities and interactions within a specific healthcare delivery organisation, with a specific focus on identifying specific definitions. Based on the result of this analysis, it is important to identify the clinical transformation objectives that a specific eHealth system is to achieve, by identifying the expected clinical and societal objectives. This process should include all relevant stakeholders and clinical staff, since they will need to identify these objectives and, more importantly, prioritise them.

These two tasks have to be supplemented by a precise understanding of all applicable national and international regulatory and legal elements which can affect the safe delivery of the eHealth system. More importantly, it is necessary to identify the funding mechanisms for the development and implementation and its following sustainability. In this context, particular attention may be directed to cost–benefit analysis, although non-financial aspects are to be considered and quantified. Particular attention should be directed to examining issues such as:

- staffing constraints;
- system operator and maintainer (user) skills;

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[37] This point is argued strongly on a recent qualitative assessment of factors affecting the implementation of eHealth: Boddy, D. et al. 'The influence of context and process when implementing e-health', *BMC Medical Informatics and Decision Making*, vol. 9, no. 9, 2009, available at: http://www.biomedcentral.com/1472-6947/9/9/pdf.

[38] An interesting approach in this context is Buccoliero, L. 'A methodological and operative framework for the evaluation of an eHealth project', *International Journal of Health Planning and Management*, vol. 23, 2008, pp. 3–20 (published online, May 4, 2007).

- the training time available;
- cost limitations for formal, informal and on-the-job skill development; and
- acceptable levels of human and system performance.

Based on the results of these activities, it would be possible to design a comprehensive business model supporting the introduction of a specific eHealth system.

In the following chapter, the report will test these initial conclusions via five illustrative case studies of eHealth systems that are financially sustainable and which have brought value and sustainability.

CHAPTER 3 Extracting value from eHealth systems: lessons from five case studies

This chapter presents the business models of five value-creating and sustainable eHealth systems in Europe in each of the four market segments identified by the European Commission in its Lead Market Initiative.[39] Building on the results of the previous chapter, it provides additional evidence for the identification of guidelines and public policy actions for the development, implementation and delivery of value-creating and sustainable eHealth systems in Europe. The chapter opens with a description of the analytical framework used to examine and compare the case study.[40]

3.1 Case study framework

Building on the elements presented in the previous chapters, the following two macro areas have been specifically examined for each case study: business model mapping and performance mapping. The first one describes the elements underpinning the business model of the case study, such as:

- customer segments – for whom is the eHealth service creating value?
- value proposition – what does the eHealth service offer to the market?
- distribution channels – through which communication and distribution channels is the eHealth service reaching the targeted users?
- customer relationship – what different customer relationships are developed and maintained in the business model?
- revenue streams – what are the revenue streams of the eHealth service?
- core capabilities – what are the core capabilities of the eHealth service?
- value configuration – what are the main activities in developing capabilities into a value proposition?
- partner network – with which partners have they worked together throughout the eHealth service process?
- cost structure – what are the most important costs of the eHealth service?

Performance mapping identifies the specific factors whose combination has led to the sustainability of an eHealth system. These are as follows:

[39] For information, see European Commission, 'Lead Market Initiative: accelerating the development of the eHealth market in Europe – Lead Market Initiative', 2007, available at: http://ec.europa.eu/information_society/activities/health/docs/publications/lmi-report-final-2007dec.pdf.

[40] Case study selection methodology is available in the annexes.

- What benefits are provided by the eHealth service to its stakeholders?
- What made the eHealth service successful or sustainable (finance model, stakeholder adoption, cost reduction, structure)?
- Which building blocks of the business model caused the sustainability of the service?

In order to identify and compare business model and performance mapping for each identified eHealth system, particular attention was directed to describe the following five elements for each case study:

1. situation overview;
2. value chain;
3. business model analysis;
4. impact analysis;
5. best practice identification.

In the section situation overview, specific attention was directed to identifying the overarching socio-economic and operational drivers for the development of the case study. Meanwhile, in the section 'value chain', the focus was on mapping all relevant partners and/or other stakeholders involved in the case study, as well as their interactions. The section 'business model analysis' examines the evolution of the underlying business model of each case study, building on the approach proposed by Osterwalder,[41] since it focuses on the identification of both financial and non-financial elements. In particular, Osterwalder focuses on four main areas:

1. offer;
2. client;
3. resources;
4. financial performance.

Each component involves different building blocks, as outlined in the following table:

Table 4 The building blocks of a business model[42]

Business model component	Building blocks
Offer	Value proposition
Client	Client segments Distribution channels Relationships
Resources	Key activities Key resources Partner network
Financial performance	Cost structure Revenue streams

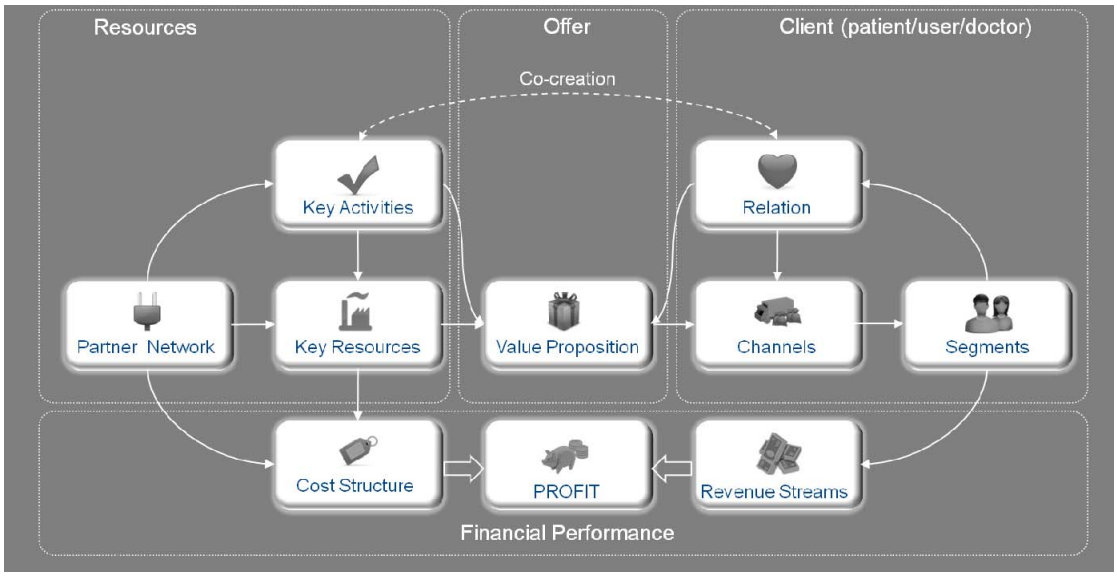
Source: Osterwalder (2009)

However, as strongly argued by Osterwalder, each building block does not operate in isolation but interacts with the others. This means that analysis of a business model should aim to understand these interrelations, as summarised in the next figure.

[41] Osterwalder, A. 'The business model ontology: a proposition in a design science approach', PhD thesis, University of Lausanne, 2004.

[42] Adapted from Osterwalder, A. 'Business model generation', available at: http://www.businessmodel generation.com (visited June 30, 2009).

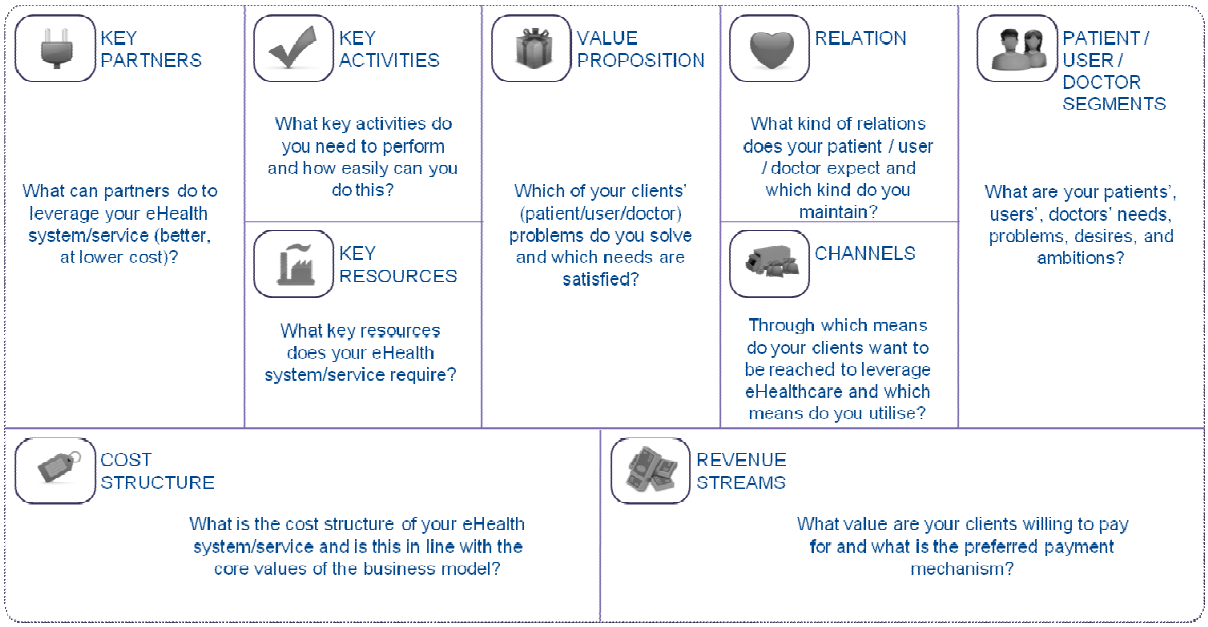
Figure 3 Business model interactions



Source: Adapted from Osterwalder (2009)

The analysis of these interactions, in any case, needs to be tailored to the eHealth domain, as described in the next figure.

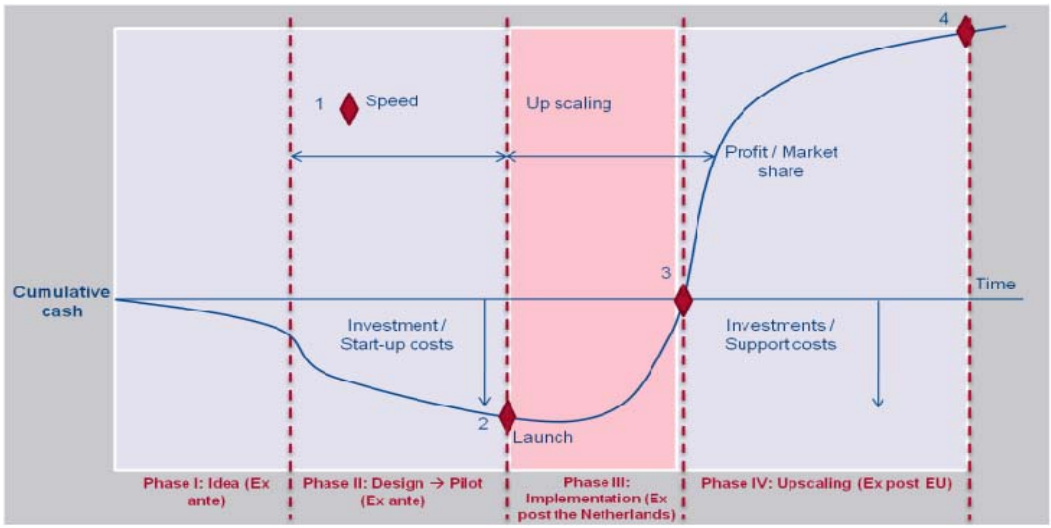
Figure 4 Building blocks of the business model



Having identified the underlining business models of each case study, attention was directed to performing an impact analysis in order to understand the operational consequences associated with introducing the specific eHealth service. Specific focus was directed towards understanding the specific internal and external benefits brought forward by the eHealth system examined in the case study.

For the internal benefits, the analysis considers specific effects within healthcare delivery organisations, such as reduction in clinical mistakes, decline in hospitalisation time, enhancement of executive reporting or the improvement of the 'brand' of a healthcare delivery organisation. External benefits refers to socio-economic implications such as decline in transportation costs and time due to the electronic delivery of test results, or less anxiety and stress for patients.[43]

Figure 5 Assessment of the S-Curve



[43] An interesting approach in this context is Buccoliero, op. cit.

The analysis assessed distinctions in relation to each of the four building blocks of a business model: resources, offer, client and financial performance. Benefits in the areas of resources and financial performance are usually internal, which means within the healthcare delivery organisation owning the eHealth system. Still, it must be noted that certain financial implications of eHealth implementations may affect interested third parties who are part of the overall value chain, such as insurance companies or national public health authorities in terms of lower claims due to efficiency gains. At the same time, benefits in the 'Offer' and the 'Client' domains are primarily externals, such as patients' stress.[44]

In the 'Resources' domain, IT applications can affect the way that healthcare activities are performed and consequently, which partners are needed. Therefore, analysis of the case studies should aim to respond to the question: 'Which attributes in the healthcare service have changed by adding electronic systems or services?' At the same time, a change in resources caused by, for example, a partner who could deliver a successful eHealth application resulting in more efficient processes, can lead to changes in financial performance in terms of cost reduction. Should this be the case, the analysis should be able to answer the questions: 'Which attributes in the cost structure have changed in order to achieve cost-effectiveness? Which new revenue streams have been identified in order to create new financial value for making the eHealth service financially sustainable?' The elements are usually described in an S-curve model per healthcare service, giving an overview of the investments/costs, revenues, profit and maturity during the entire development and implementation phases of an individual eHealth system.[45]

The structuring of an S-curve is not always possible, especially when a system is not aimed at providing direct positive financial returns but rather at socio-economic benefits. As previously argued, the sustainability of eHealth systems cannot be measured exclusively via a financial perspective. The measurement must include 'soft' elements such as the development of new organisational capabilities to correctly manage the changes brought about by introducting the eHealth system.

When examining external benefits, the most important are primarily social and apply to relevant stakeholders such as patients, relatives, voluntary aid givers or general practitioners (GPs). These benefits are usually measured in terms of ownership, trust and commitment by all end-users to exploit the functionalities of an eHealth system.[46] Stakeholders' needs and requirements can be viewed as measurable parameters for the identification of external benefits. This can be measured via a consumer relevancy model, based on Maslow's hierarchy of needs.[47] This model indicates that all client-centric

[44] Rahimi, B. 'Methods to evaluate health information systems in healthcare settings: a literature review', *Journal of Medical Systems*, vol. 31, 2007, pp. 397–432.

[45] Adapted from Giesen, D.J.E., Van de Vrande, V. and Klokgieters, K.K. 'Business model innovation: the role of co-creation in the realisation of business model change', forthcoming.

[46] See also Paul, D.L. et al. 'Assessing technological barriers to telemedicine: technology-management implications', *IEEE Transactions for Engineering Management*, vol. 46, no. 3, 1999, pp. 279–288; Nir, M. 'Factors affecting the adoption of telemedicine: a multiple adopter perspective', *Journal of Medical Systems*, vol. 28, no. 6, 2004, pp. 671–632: Leonard, K. 'The role of patients in designing health information systems: the case of applying simulation techniques to design an electronic patient record (EPR) interface', *Health Care Management Science*, vol. 7, pp. 275–284, 2004; Conley, E.C. et al., 'Simultaneous trend analysis for evaluating outcomes in patient-centred health monitoring services' *Healthcare Management Science*, vol. 11, 2008, pp. 152–166.

[47] Maslow, A.H. *The farther reaches of human nature,* 1968.

transactions can be reduced to five essential elements: price, product, service, access, and experience,[48] as described in the next table. It is evident that a value-creating and sustainable eHealth system has to provide benefits in all five factors.

Table 5 Impact analysis factors

Attribute	**Overview**
Access	Ease in accessing and exploiting the functionalities for performing specific activities
Product	Level of performance and innovation brought about by the eHealth system in the delivery of a specific healthcare service
Price	Value for money
Service	Level of flexibility and ability to scale the eHealth system to accommodate new functionalities
Experience/ intimacy	Level of emotional connection with the healthcare service

3.2 Case studies

Having introduced the analytical framework, the following paragraphs apply it to each of the cases studies. As anticipated, the analysis involves five illustrative case studies, each one covering the eHealth sectors described in the context of the EU Lead Market Initiative. These are as follows.

Case study	Lead Market Initiative classification
Telemedescape	CIS
Centro Unico di Prenotazione (CUP)	SUNCS
Tactive	Telemedicine
University College London Hospital (UCLH)	Telemedicine
Naviva	IHCIN

3.2.1 Telemedescape

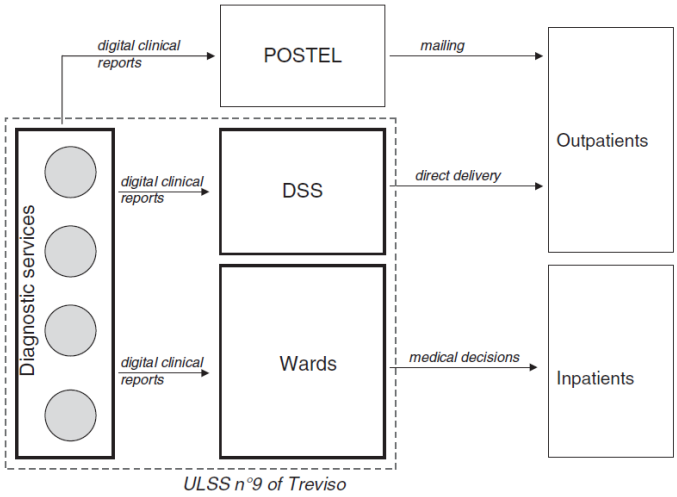
Situation overview

Telemedescape is an electronic managing system for digitally signed test results. The system was developed by Treviso's local health authority no. 9 (ULSS No. 9), one of the prominent cities in Italy's Veneto region. This authority provides healthcare services to 407,000 citizens distributed over 37 municipalities, employs 4,300 individuals and involves 500 specialists and GPs. The main hospital is based in the city of Treviso with a small unit in Oderzo. The two structures have 1,272 hospital beds and 70 wards that manage more than 55,000 admittances per year.

[48] Crawford, F. and Matthews, R. *The myth of excellence: why great companies never try to be the best at everything*. (Amsterdam, Crown Business), June, 2001.

Telemedescape provides the following functionalities. First, it allows for the digitalisation of clinical documents produced by the diagnostic services of the Treviso main hospital's laboratories and radiology departments for forwarding to units and wards. The same process is applied to clinical documents produced by the hospital diagnostic centres and sent to the six local health districts, which forward them to patients. Currently, the system allows for an average of 7,000 digitally signed test results daily.[49] In 2003, these functionalities were extended with the possibility of sending clinical documents directly to patients using Postel, the printing and delivery service of Poste Italiane (Italy's postal service operator). With this system, the hospital diagnostic services send the digital document to Postel, which prints and mails them to patients who have given their consent to this form of document delivery. The next figure provides an overview of the system.

Figure 6 Telemedescape architecture



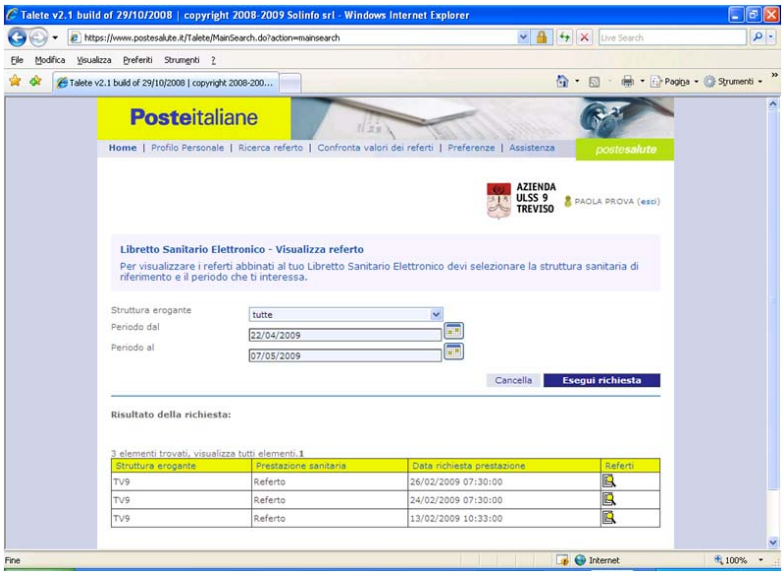
Source: Buccoliero (2008)

In 2009, the functionalities of the system were extended further through electronic delivery of clinical documents directly to patients. This new functionality uses the IT infrastructure of Postesalute (Poste Italiane's eHealth unit). Clinical documents are digitally signed by the hospital's diagnostic services, which then forwards them to patients, who can access them securely from their personal computer. Since its launch, more than 1,600 test results have been accessed and downloaded daily.[50] This service is presently offered for free, although the local health authority is considering applying a small charge. Moreover, it is important to emphasise that these digital documents have full legal validity since they are digitally signed, in line with all applicable Italian legislation. The next step in progress is to consolidate an electronic patient record using the current IT infrastructure so that patients can store their medical records for a pre-defined time.

[49] Soldano, E. 'Verso un ospedale senza carta', presentation at Security Summit 2009, June 9, Rome.

[50] Soldano, ibid.

Figure 7 Postesalute screenshot



The system cost EUR400,000 for system integration and software development by external partners. Internal costs were calculated to be 24 man-months, out of which:

- 2 man-months were for hospital staff;
- 18 man-months were for administrative staff;
- 4 man-months were for IT staff.

Regular maintenance costs range at around EUR 20,000 to cover external consultancy support, while internal efforts have been quantified as two man-months.

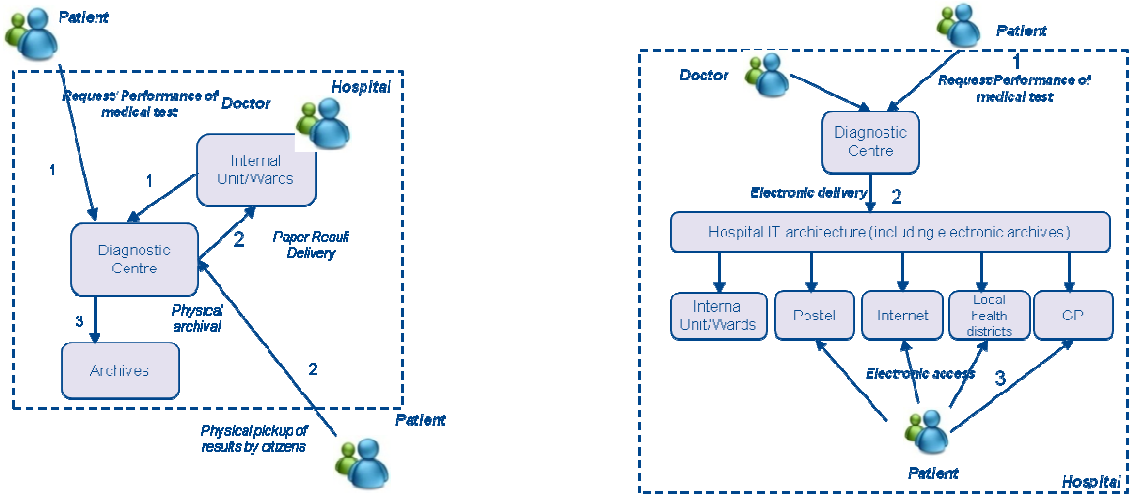
Currently, Telemedescape is being integrated with local pharmacies and is becoming the underlying infrastructure for the development of a regional health patient record system. Finally, the system has entered the Reuse programme, an initiative of the Italian Government that facilitates the re-use of successful IT services by other local authorities. In the case of Telemedescape, the solution is in the process of being implemented by the Lazio region.[51]

Value chain

The network and partners in both the healthcare value chain and the eHealth value chain associated with this service are visualised in the next figure

[51] Soldano, ibid.

Figure 8 Telemedescape value chain evolution (pre- and post)

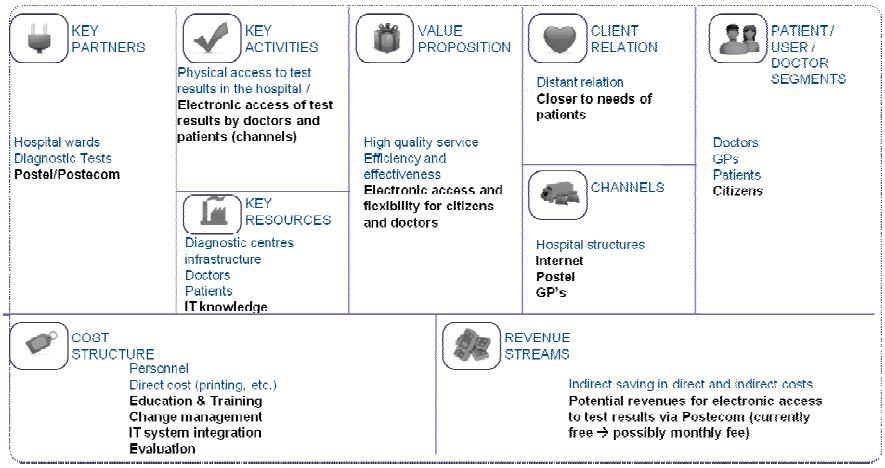


The diagram on the left describes the state of affairs prior to implementing the Telemedescape system. Within the hospital, the entire process was based on paper, and therefore labour intensive and prone to errors and delays. If tests were provided to outpatients, citizens were required to physically come to the hospital in order to collect them. Meanwhile, the Treviso hospitals and its diagnostic centres were forced to keep paper copies in compliance with applicable national legislation. The introduction of the system has completely changed the situation: diagnostic centres can provide test results electronically to hospital units and wards, and outpatients can access them online from the comfort of their home or receive them by mail. The patient can still go to local authorities to pick up the clinical documents, should this be required. At the same time, the Treviso hospital is able to cut storage by saving the documents electronically and applying all the required technical controls so as to maintain compliance with national legislation.

Business model analysis

Telemedescape has substantially changed the underlying business model of delivering and managing test results. First, it has extended it by allowing both electronic and physical delivery of clinical documentation. Second, as soon as all the technical and organisational issues are addressed, GPs and pharmacies are expected to be provided access to these electronic documents via the electronic patient record functionalities devised by Postesalute.

Figure 9 Telecomedescape – business model changes



NB: Text in bold indicates changes brought about by introduction of the eHealth system

In addition, Telemedescape has increased the value proposition of the delivery and management of clinical documents. It has provided patients with flexibility of access and the possibility to choose how to receive the results of their clinical test. The Treviso hospital has decided to move closer to patients' needs by providing a set of new channels for the delivery of clinical test results. The development of Telemedescape has led to additional costs, including expenses for education and training of medical staff and change management. Overall, the local health authority has organised a total of 300 days of training, of which more than 100 were for medical staff and the rest for administrative and IT personnel.[52] However, as will be argued later, these costs have been offset by the efficiencies gained both internally at the hospital and externally with citizens.

Particular attention has been directed towards evaluating the performance of the system in order to identify possible corrective action, should this be needed. Nevertheless, these costs have been offset by gains in internal efficiency and the consolidation of the Treviso hospital's 'innovation brand'. Finally, it is possible to foresee a raise in revenue, should the Treviso Hospital and its IT partner Postesalute decide to levy a charge for those patients who want to access their clinical documents electronically. Currently, the system is still provided for free.

Impact analysis

The section highlights the internal and external benefits related to the Telemedescape system.

Internal benefits

Introducing the digitalisation of the production and distribution of clinical documents from diagnostic laboratories has led to operational efficiencies. First, the process of production and delivery of clinical tests has been cut by 50%, since hospital staff are not expected to prepare documents to be collected by patients. Now, as soon as the clinical document is prepared electronically, it is digitally signed by the responsible doctors and sent to the patients electronically or via the Postel service. The hospital has quantified that this has allowed the reallocation of staff, leading to EUR480,000 in direct savings. In

[52] Data from CNIPA, Programma di Riuso, available at: http://riuso.cnipa.gov.it/soluzioni/anteprima.bfr?id=252 (visited September 10, 2009).

terms of direct costs, the system allows for savings of EUR42,000 in consumables (printing, cartridges, etc.) and EUR15,000 in storage space on a yearly basis.[53] In addition, the system has allowed for the reduction of mistakes associated with physical management of clinical documents; moreover, it has simplified the overall verification and correction process, should mistakes be found. Evaluation of the initiative has concluded that introducing the system has led to a 10% decline in clinical mistakes, and therefore to better patient care.

An additional internal benefit is associated with the significant reduction (from 23 to 11 hours) in the average waiting time related to the delivery of clinical documents to patients for diagnostic and therapeutic purposes. This aspect is extremely important from a clinical perspective, since it implies greater timeliness of diagnosis and the possibility of starting targeted care in shorter timeframes.[54]

External benefits

Access by patients is the main benefit associated with Telemedescape: it can be quantified in the reduction of transportation cost and time devoted to picking up reports. An independent evaluation of the system has quantified these benefits at EUR4,072,826 associated with the delivery of clinical documents via the Postel service.[55] This was calculated by estimating patients' transportation costs to physically collect a report via private means (car) and public transport. The cost of time spent in picking up the report was added via an estimation of the utility loss based on the opportunity cost method. These external benefits are not just limited to the Treviso hospital; a nearby local health authority also implemented a similar system in 2006. After two years, more than 40% of laboratory test results were accessed and reviewed on the web.[56]

Best practice identification

Analysis of the case study allows for the identification of the following best practice.

- It is important to emphasise continuous strong senior management support. The director general of the ULSS No. 9 Treviso hospital conceived the strategic nature of the project and pushed for it during all of its phases. Together with his staff, he had a clear strategic vision of Telemedescape as a core IT infrastructure through which it would be possible to move the local authority towards full implementation of an electronic patient record, and the networking of other interested actors such as pharmacies and specialist doctors. Essentially, there was a strong willingness to preserve the innovative reputation of the healthcare delivery organisation.
- Senior management was committed to support change management. It was evident that the introduction of this system was going to have a direct impact on the daily activities of medical and administrative staff. This called for training and support for change management to ensure that staff would not be 'scared' by the introduction of Telemedescape. Instead, they could appreciate the efficiency that this tool was going to bring to their daily activities.

[53] Data from Silvia Giovannetti, 'AziendaULSS9–Treviso: Da ESCAPE al Libretto Sanitario Elettronico' Presentation at LUISS eHealth Executive Master, Rome, May 18, 2009.

[54] See Buccoliero, op. cit.

[55] Ibid.

[56] Arsenal.it, 'Observatory and projects on telemedicine applications', Notebook 1/2008, 2007. p. 86.

- Throughout the entire development of the system, staff were given time to participate in its design and implementation, in order to avoid a situation where they would go back to carrying out their activities as they did prior to the arrival of Telemedescape.
- Strong senior management was confirmed by commitment to a decision to independently evaluate system performance. This evaluation involved both qualitative and quantitative elements, and was aimed at understanding not only the internal benefits, but also the benefits for patients and citizens as a whole.

3.2.2 Centro Unico di Prenotazione – Umbria–Farmacup (SUNCS)

Situation overview

The CUP is an electronic solution allowing patients to book, reschedule, cancel and pay for specialist visits or laboratory tests requested by their GPs. The system supports the following functionalities: after a visit to a GP or a hospital stay, a patient is prescribed laboratory tests or a visit with a specialist. The patient goes to a CUP contact point where the operator suggests possible appointment slots. At the time of the booking, the patient can pay the required ticket, unless special conditions apply; also, they may visit the CUP contact point to cancel the visit or test, or to reschedule to a new date.

The system is targeted to serving patients who are resident in Umbria, a region in central Italy. Currently, the region has a population of more than 872,967 inhabitants, with about 400,000 residing in rural areas. In fact, the population density is just over 100 citizens per square kilometre. Its population is rapidly ageing and at the present time, more than 55% of the population is more than 50 years old, of which more than 70% reside in rural areas.[57]

From an IT perspective, the system has a relatively simple client–server architecture supported by a centralised database hosted by Web-red, the Regional Government of Umbria's in-house IT company. It is based on an intranet composed of six interlinked communication infrastructures, one for each regional local authority. Webred also provides first and second-level helpdesk support and assistance during the negotiated standard office hours. Due to the sensitivity of the data handled by the system, strong authentication has been implemented.[58]

CUP development began in 1999 with initial integration of the individual system for each local authority. The first version of the system was released in 2000 and jointly involved all six local authorities as points of contact. Afterwards, it was decided to link directly to all 266 pharmacies operating in the region, of which 144 were operating in rural areas. The system also links 487 specialist doctors and laboratories which have signed a reimbursement agreement with Umbrian regional healthcare authorities. While the specialist doctors act as service providers, the pharmacies are CUP contact points. Future plans involve integration of the CUP system with local GPs to create a comprehensive regional e-prescription service following the current test involving 15 GPs. The regional CUP system is directly linked to Italy's Ministry of Economics and Finance and the Ministry of Health, as part of the regular information exchange regulating reimbursement between central government and the Umbrian regional health authority. According to official statistics, in 2009 the CUP system handled 4.6 million transactions, equally distributed between requests for tests and specialist visits. Of these transactions, 25% were

[57] Data extracted from Istituto Nazionale di Statistica, Conoscere l'Umbria, vol. 12. Perugia, Istituto Nazionale di Statistica, 2008.

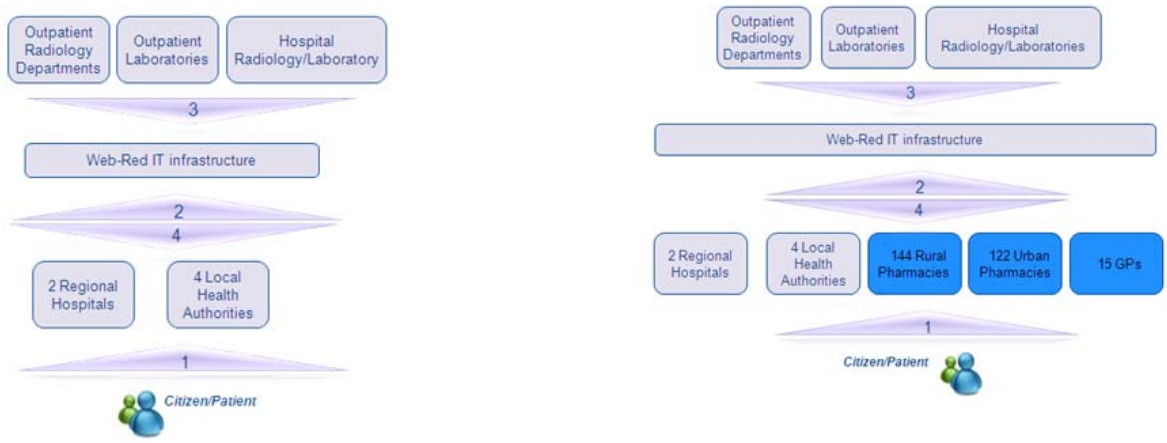
[58] Interview with Francesco Solinas, healthcare manager, Webred, Perugia, May 10, 2009.

via pharmacies, which represent a 3% increase compared to 2008. The remaining were done directly from the main regional hospitals in Perugia and Terni and four other local health centres.[59]

Value chain

The network and partners in both the healthcare value chain and the eHealth value chain associated with this service are visualised in the next figure. .

Figure 10 CUP value chain (pre- and post)



The diagram on the left presents the situation prior to the introduction of the CUP system. Patients could only book, cancel, reschedule and pay for tests and specialist visits at six points – the two regional hospitals and four local health centres. This meant that inhabitants in rural areas had to travel relatively long distances just for these simple tasks. The involvement of all pharmacies of the region in the system has significantly extended the reach of the service. In fact, the 266 pharmacies have a strong territorial presence, in particular the rural ones. Patients in these areas are not required to travel to other locations for these activities: their travel is restricted to taking the tests or undertaking specialist visits. Nevertheless, this travel effort is very limited due to the presence of more than 589 specialist doctors and diagnostic centres in the region. The future extension of the system to GPs is expected to spread this coverage even further, providing a more direct service to patients.

Business model analysis

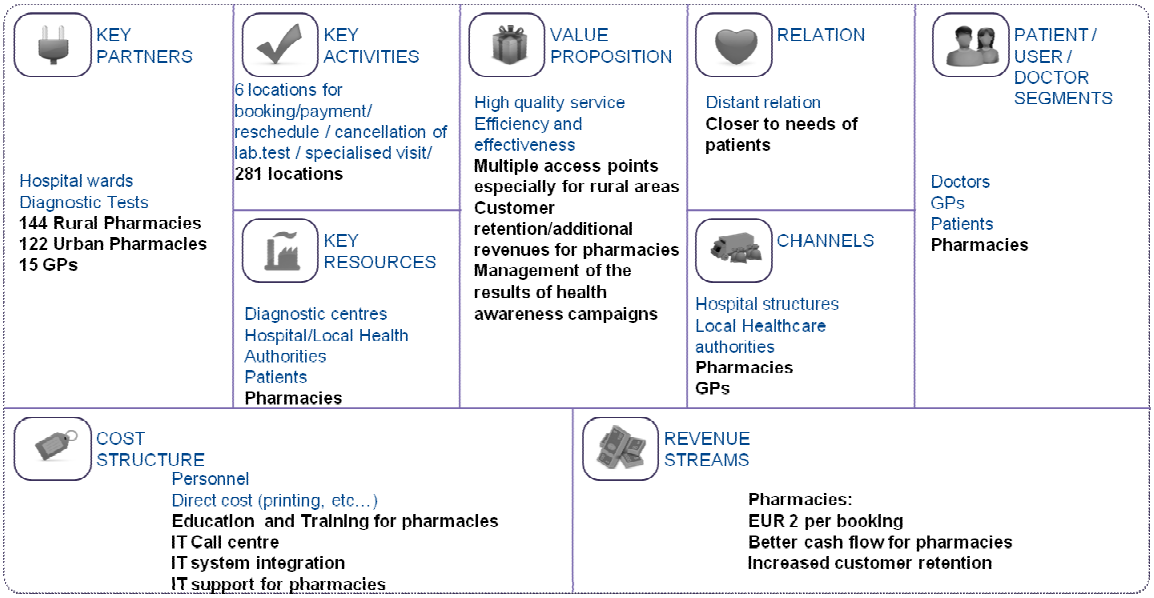
The introduction of the CUP system has significantly changed the underpinning business model related to the management, booking, cancelling, rescheduling and payment of specialised tests and visits requested for patients by their GPs and subsidised by the Italian National Health Service. It is evident that extension of the service to 266 pharmacies and to 15 GPs has augmented the number of CUP key partners, activities and resources, leading to an increase in the overall value proposition of the system.

It has created new channels and improved relations in terms of a regional healthcare system closer to the specific needs of patients. The development of the system has required some additional operational costs for the regional health authority, and partially for

[59] Ibid.

pharmacies. The former category of costs has been overcome by the indirect financial gains achieved by pharmacies in terms of increased customer retention and better cashflow.

Figure 11 CUP business model evolution



NB: Text in bold indicates changes brought about by introduction of the eHealth system

Impact analysis

The section highlights the internal and external benefits related to the CUP system.

Internal benefits

Development and implementation of the CUP has led to significant internal benefits, in particular for pharmacies and the regional health authorities. Initially, pharmacies were not interested in becoming part of the CUP systems: they saw the introduction of this service as an additional administrative burden on their activities, which are aimed primarily at selling medicines and related goods.[60] Therefore, the regional health authorities decided to provide a set of operational incentives for pharmacies. The first was that the regional authorities would pay EUR2 for each booking, cancellation or rescheduling of a visit or tests done via the CUP system, while the service remained free for patients. It also provided pharmacies with free hardware and an ADSL line and, should broadband not be available, reimbursement was provided for accessing the service via modem. In addition, support was directed towards assisting pharmacies' cashflow: in fact, it was decided that the sums of money collected from patients as prepayment for a test or a specialist visits would not be transferred immediately to the regional health authorities. Instead, pharmacies would be given a 30-day grace period so that they could use these funds to compensate for the reimbursement of prescriptions subsidised by the regional health authorities. [61]

[60] Interview with Francesca Duranti, owner of Farmacia Tarpani, Perugia, May 11, 2009.

[61] Information extracted from Atto Aggiuntivo all'Accordo Contrattuale per la Disciplina dei Rapporti con le Farmacie Pubbliche e Private concernente il servizio Farmacup sottoscritto da Federfarma, Assofarm e Azienda USL 3, firmato in Foligno, February 27, 2009 (Annex to Service Agreement concerning the CUP service between the regional associations of public and private pharmacies – Federfarma and Assofarm, and Local Health Authority no. 3 of Umbria, signed in Foligno, February 27, 2009).

Following introduction of the CUP, pharmacies have noticed an increase in their sales, since it has provided an additional reason for going into a pharmacy. As indicated by a local pharmacist, the introduction of the CUP has led to a 20% increase in general sales.[62]

Moreover, regional authorities have benefited significantly from the service. They have been able to put forward a service that pushes patients to take a specific test or undergo a visit, while managing waiting lists better. In fact, the system allows for automatic suspension of bookings for laboratories or specialist clinics with extensive waiting time and redirection towards other venues.[63] Furthermore, it has reduced the percentage of no-shows, since individuals can easily cancel their reservation, should they not be able to undergo the test or attend the visit. It has allowed for the implementation of a system for confirming appointments, especially for tests and specialist visits with chronic long waiting times, as the health authorities use patients' contact details to remind them of their visit. Finally, regional authorities can use the CUP to monitor the effectiveness of their awareness campaigns. For example, regional authorities invite all women over 30 years old to undertake free breast cancer tests by booking via the CUP system. It is evident that regional authorities have the required information for measuring the effectiveness of the campaign by monitoring how many women actually undertake tests.

External benefits

Access is the dominant benefit associated with the introduction and development of the CUP. Irrespective of their location, citizens are provided with a capillary presence over the regional territory for booking, scheduling, cancelling and paying for a specialised test or visit. This benefit is extremely important for senior citizens living in rural areas with difficulties in going to local health authorities for mundane activities, such as booking a visit or a test. They can easily go to their local pharmacy where they are known and supported. In addition, access as a benefit is expected to be increased with future evolution over the web. In fact, Webred and the regional health authorities are examining ways to allow individuals to complete and manage their booking online, as the national legal framework already allows this process; the real difficulty lies in managing the risk of patients being unable to make correct bookings for certain complex tests or visits. Therefore, Webred is thinking of concentrating on devising web-based CUP functionalities mainly for managing bookings concerning relatively simple and routine visits, or tests such as a blood test or ultrasound scans.[64]

Best practice identification

Analysis of the case study allows for identification of the following best practice.

- The regional healthcare authority's senior management understood that it was necessary to offer incentives to pharmacies in order for them to join the system, in light of the category's historical reluctance to go beyond its core activities. After having overcome the initial reluctance, Umbrian pharmacies are now fully committed, since they have noticed the benefits in terms of sales.
- Another identified best practice has been very operational. Regional health authorities clearly understood that CUP could improve the way that healthcare service in general is delivered, irrespective of the geographical morphology of the region. Pharmacies were the point of entrance and delivery of a service.

[62] Interview with Francesca Duranti.

[63] Interview with Francesco Solinas.

[64] Interview with Francesco Solinas.

- The development and implementation of the system also present interesting food for thought. The decision was to develop a very reliable client–server application supported by a centralised database based on open standards and technology. The easy interface and the associated first and second-level helpdesk make sure that pharmacies are comfortable with the system, even if they have limited technical expertise.

3.2.3 Tactive (telemedicine)

Situation overview

Developed by Tactive, Tactus delivers online care and treatment to Dutch citizens affected by alcoholism. Overall, it performs more than 5,500 units of care per year with an operational budget of EUR 1,605,000.[65] Its activities are targeted at alcohol addicts residing in the eastern part of the Netherlands.

Alcoholism is a prominent problem in the Netherlands leading to direct financial damage to Dutch society of about EUR2.58 billion.[66] According to official statistics, only 10% of Dutch alcohol-addicted citizens receive appropriate support.[67] Therefore, the main driver for this system has been the need to increase this low percentage by providing an anonymous professional support system,[68] since Tactus-sponsored research concluded that preventative action in treatment can improve behavioural changes in individuals affected by alcoholism.[69]

Tactive developed an online tool in conjunction with the IT supplier TheFactor.e, which allowed structured asynchronous interaction between counsellor and patient. The goal was to replicate cognitive behavioural therapy centred on one-to-one counselling by a professional assistant in an online environment. This internet-enabled treatment programme consists of:

- two-sided treatment (diagnostics and behavioural change);
- an informative website;
- a forum for online contact with fellow sufferers;
- internet-based treatment (on a secured platform); and
- an aftercare chat module.

This electronic service involves four organisations:

- Tactus (franchiser);
- Tactive (franchisee);
- Mondriaan (franchisee); and

[65] Tactive annual report 2008, available at: http://www/tactive.nl.

[66] Keizer, H., Postel, M., Westendorp, H. and Brenninkmeijer, M. Ontwikkeling *Alcoholdebaas.nl, Internetbehandeling, Resultaten Scoren*, April, Amersfoort, GGZ Nederland, 2007, and interviews with M. Postel, M. Westendorp and Hans Keizer, Tactive employees, June 2009.

[67] Interview with Hans Keizer, June 2009.

[68] Keizer, H., Postel, M., Westendorp, H. and Brenninkmeijer, M. (2007). *Ontwikkeling Alcoholdebaas.nl, Internetbehandeling*, Resultaten Scoren, April., Amersfoort, GGZ Nederland, 2007.

[69] Postel, M.G., de Jong, C.A.J. and de Haan, H.A. (2005) *Internetbehandeling www.alcoholdebaas.nl. Een zoektocht naar literatuur*. Amersfoort: GGZ Nederland, Resultaten Scoreno.

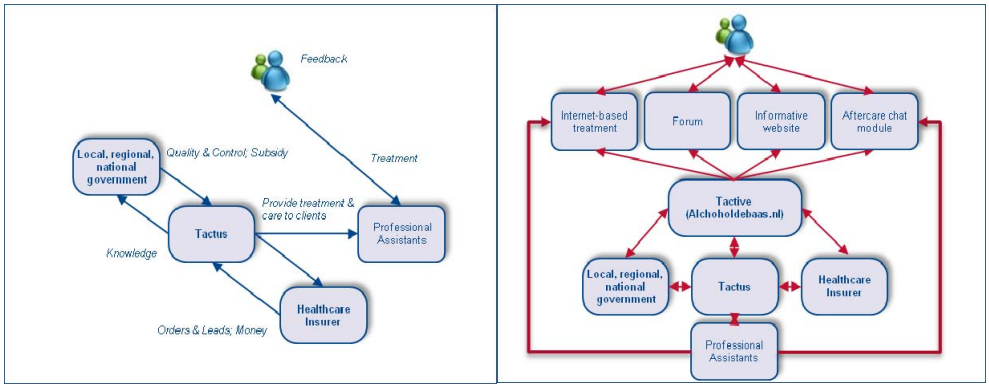
- the Symphora Group (franchisee).

These franchiser and franchisees provide teleconsultations and see the internet as a way to consolidate their offering beyond the current geographical presence in the eastern part of the Netherlands. Moreover, since the IT platform is made of easily customised applications, it is believed that it could be scaled to address other treatments for ailments such as drug abuse, medication abuse, gambling and eating disorders.[70]

Value chain

The network and partners in both the healthcare value chain as well as the eHealth value chain associated with this service are visualised in the next figure .

Figure 12 Tactive value chain (pre- and post)



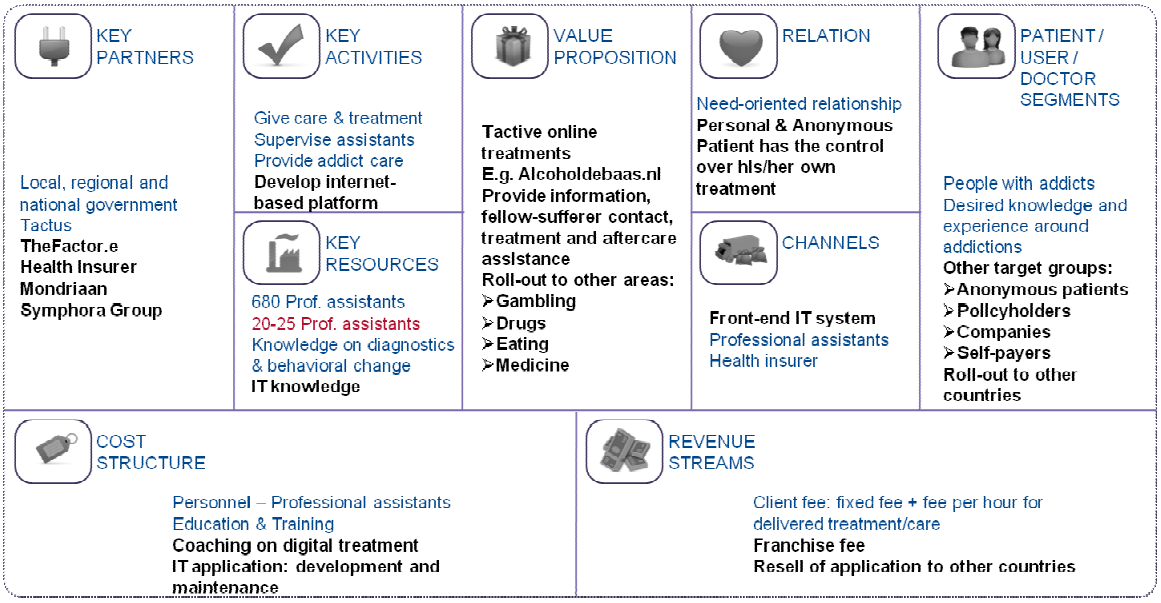
The two figures provide an overview of the changes in the value chain associated with the treatment of alcohol addiction following the introduction of the new IT system. As emphasised on the diagram on the left, it is evident that the entire treatment process was centred on face-to-face meetings between the patient and the professional. In addition, interactions with local and national authorities and health insurers were paper-based. Introducing the online platform has changed this situation completely: alcohol addicts can access their nominated assistants anonymously via the online platform, while Tactus can manage interactions with individual healthcare insurers and the relevant national, regional and national public health authorities more efficiently. Interactions with the latter actors are extremely important, since it simplifies the overall reimbursement process, even if the service *per se* is provided anonymously.

Business model analysis

The next figure provides an overview of the changes in the business model to the delivery of treatment to alcohol addicts following the introduction of the online platform.

[70] Interviews with Marc. Postel, Marit. Westendorp and Hans Keizer.

Figure 13 Tactive's business model



NB: Text in bold indicates changes brought about by introduction of the eHealth system

As previously anticipated, the core changes in the business models are the possibility of providing online treatment in complete anonymity (Relation), potentially addressing other forms of addictions (Value Proposition). Moreover, by providing asynchronous online support, it has led to a reduction in the number of professional staff required.

Due to the ability to scale the IT platform, its potential revenue streams have evolved. Prior to introduction of the online platform, revenues were obtained only from the fees paid by individual alcohol addicts. However, the organisation is to develop a reseller fee that allows for treatment organisations in other countries to consider use of the available online platform to offer similar treatments locally. Currently, the organisation is considering the possibility of consolidating a 'franchise' model so that other organisations can license its services for a fee.

Impact analysis

The section highlights the internal and external benefits related to this online platform that make this eHealth service sustainable.

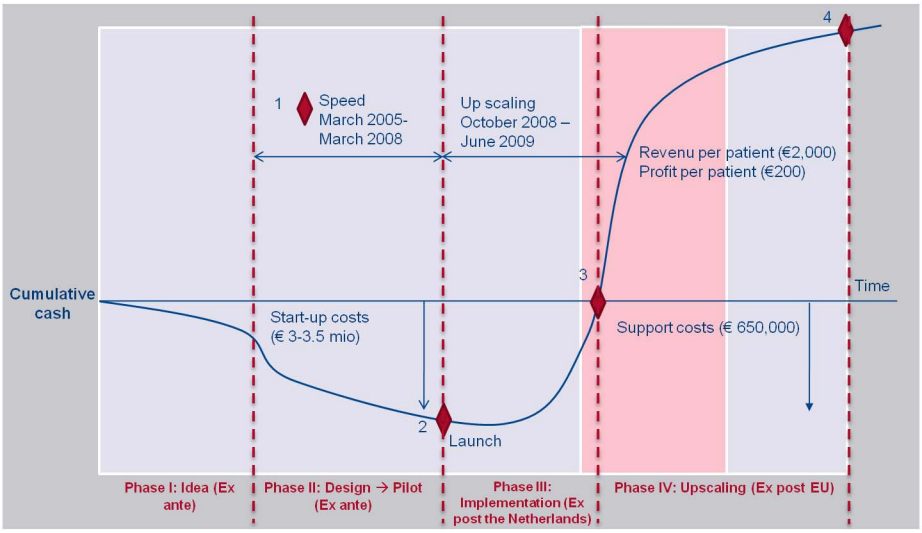
Internal benefits

When considering the development of this online system, Tactive decided to change its operational focus by moving away from exclusively being a treatment operator to turning into a platform provider – however, this did not mean that it was abandoning treatment activities. It continued to involve a restricted number of professional assistants for face-to-face treatments, if required. These activities are now supported by a front-end application. The organisation was able to measure other direct effects following introduction of the IT solution: it has noticed a significant decline in internal costs caused by less administrative burden and the use of on-site consultation rooms. In addition, there was a significant digitisation process, since a large part of the diagnostic list was managed electronically. Finally, the organisation witnessed a 30% decline in 'no-shows' (which means patients failing to attend or participate in face-to-face meetings).

The financial benefits were visible. Tactus invested EUR3–3.5 million of private equity funding in Tactive to develop this solution. Moreover, Tactive has gained additional funding (EUR650,000) for their online treatment from M&ICT (an action programme of the Dutch Government to contribute to societal problems) because of the innovative nature of their solution in terms of value for patients. This additional funding was reinvested to improve the scale of its online activities.[71] Using the provided data, it has been possible to extract an S-curve to assess these benefits.

Figure 14 S-curve of the Tactive case

[72]



Presently, the service generates revenues for EUR2,000 per patient, with an estimated profit of EUR200 per patient. The profit is used to take this service internationally and to counter other addictions.

External benefits

Tactive dominates on access, as it enables easy interaction between professional staff and addicts. In particular, the anonymity herein is the key to its success: Tactive has found that 96% of its users prefer this feature in the service.[73] Moreover, it registered 5,000 unique visitors per month and 700 regular forum members between January and June 2009.[74] The online platform has allowed Tactive to differentiate its offering by moving beyond face-to-face treatments. More importantly, company statistics confirm that online treatments are perceived better by patients. Of all patients who start treatment online, 61.2% move to the second part of the treatment, while 36% complete it. This data does not indicate that 64% of them fail to continue treatments: some of them indicate that they have had enough support to stop the treatment after the first phase. It is important to indicate that this online treatment is to be considered as an additional option for

[71] Interviews with Marc Postel, Marit Westendorp and Hans Keizer.

[72] Adapted from Giesen, D.J.E., Van de Vrande, V. and Klokgieters, K.K. 'Business model innovation: the role of co-creation in the realisation of business model change', forthcoming.

[73] Postel, M.G., de Haan, H.A. and de Jong, C.A.J. 'E-therapy for mental health problems: a systematic review', *Telemedicine and e-Health*, in press.

[74] Postel, M.G., de Jong, C.A.J. and de Haan, H.A. 'Does e-therapy for problem drinking reach hidden populations?', *American Journal of Psychiatry*, vol. 162, no. 12, 2005, p. 2393.

traditional face-to-face treatment. Addicts can always return to face-to-face treatment provided by the organisation if required.

Another benefit is the empowerment of alcohol addicts in their treatment. Since the treatment is usually conducted in two different phases (diagnostics and behaviour) to be delivered online, power is vested in the hands of the client. They are the captain of their own destiny. This element is expected to increase the effectiveness of the method and the final results.

Best practice identification

The analysis of this case study allows for identification of the following best practice.

- Senior management had a clear vision on how to operate an online treatment service and infuse strong commitment in making the transformation a success. The strategic objective was to implement an online platform that provided a valuable tool for personal counselling to alcohol addicts.
- This strong commitment was underpinned by a detailed prior identification of the functionalities that the new online platform was expected to deliver. Even after delivery of the online platform, senior management monitored the situation regularly and carried out regular feedback sessions and enhancement cycles.
- It is important to emphasise that the design and delivery of the online system saw the continuous engagement of professional assistants who received the required training and support. Finally, the sustainability of the online service was achieved by setting up a franchise model, wherein Tactive gains revenue from these franchisees. This provided the stepping stone for future roll-out of a similar online system to address other forms of addiction in the Netherlands and in other countries.

3.2.4 University College London Hospital (telemedicine)

Situational overview

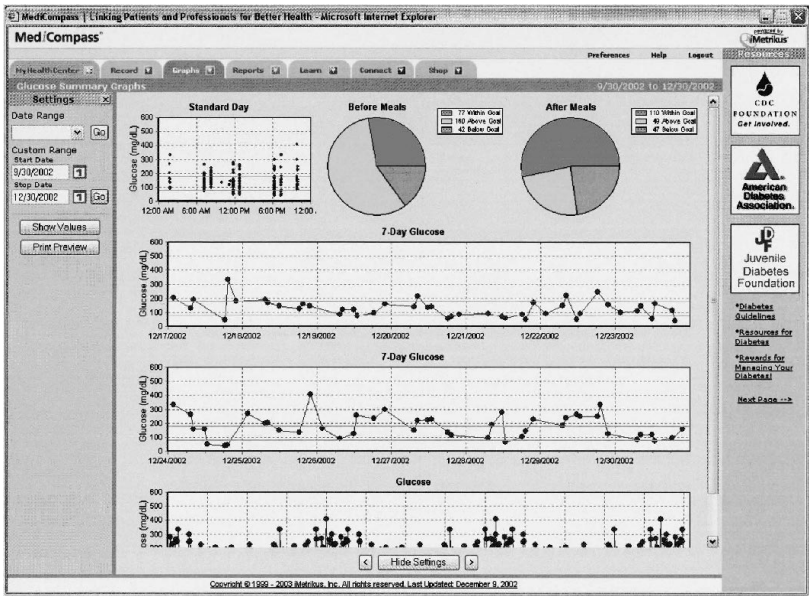
The Department of Paediatric Endocrinology at UCLH serves a population of about 2000 children and young people affected by diabetes. One of the main drivers to implement IT applications is that 85% of the children and young people in the UK with diabetes type-1 do not have it under control.[75] It is vital that these patients understand how much insulin is required to have a normal healthy life.

Therefore, UCLH partnered with the NHS, Great Ormond Street Hospital, iMetrikus and Capgemini Consulting to implement an eHealth service supporting young patients and their parents. The solution allows for the electronic upload of blood glucose results from home by plugging into blood sugar meters and automatically uploading the results. These results are available to clinicians and nurses who can intervene proactively when and if needed, or call patients to give advice or guidance.

[75] Interview with Andrew Jaminson, Head of Health and Social Care, Capgemini UK, June 2009.

Figure 15 Medicompass Pro health management system charts point of care data

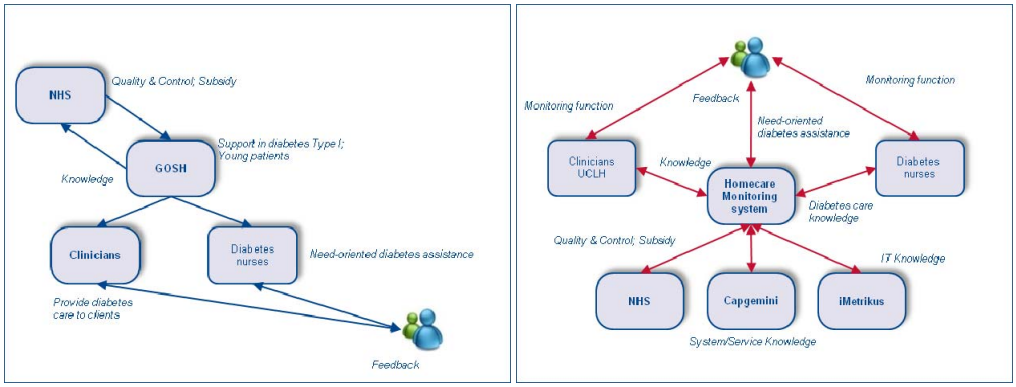
[76]



Value chain

The network and partners in both the healthcare value chain and the eHealth value chain are visualised in the next figure .

Figure 16 UCLH diabetes telemedicine (pre- and post)



NB: GOSH stands for Great Ormond Street Hospital, UCL, London

All system partners have been gathered into the paediatric diabetes 'federation', which is a clinical network covering the area encompassing the five boroughs of north and central London.[77] The programme leaders were Jane Pringle and Dr Peter Hindmarsh, with the support of relevant actors from across north and central London. The two diagrams clearly demonstrate the changes in the value chain following the introduction of this eHealth system. Previously, young patients had to provide regular feedback of their status via physical meetings or other delayed methods. By introducing the IT application, a

[76] Bailey, T.S. 'Use of an electronic diabetes registry augmented with low-cost device connectivity', *Point of Care,* vol. 2, no. 3, 2003, pp.203–207.

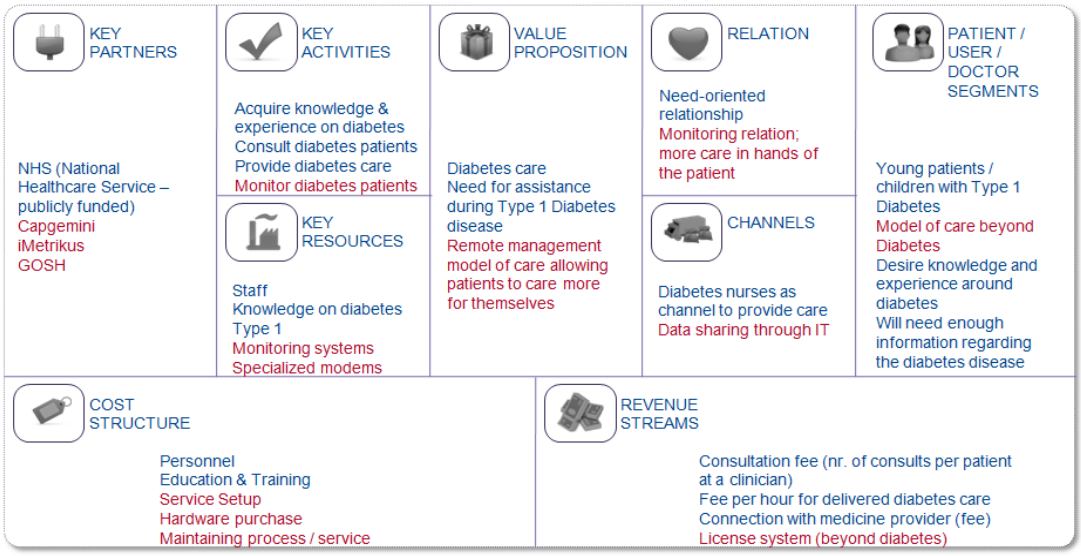
[77] Http://www.ich.ucl.ac.uk/cypph/clinical_learning.html#diabetes

homecare remote monitoring system came into place by facilitating the overall monitoring of diabetes among young children treated from a distance. The whole area of London is participating, which means that all UCL hospitals and Primary Care Trusts cooperate. The goal is to deliver a total solution for young diabetes patients in order to monitor and act on their disease.

Business model analysis

The cooperation between UCLH, Great Ormond Street Hospital, iMetrikus and Capgemini was set up to form a pact and influence the value chain, as indicated above. The next picture provides an overview of the changes in the business model, following introduction of the specific IT system.

Figure 17 UCLH's business model



NB: Red text indicates changes brought about by introduction of the eHealth system

The introduction of this IT system has extended the value proposition of the diabetes monitoring service managed by UCL hospitals. It has allowed for the development of a remote management model through which young patients and their parents can monitor their conditions in cooperation with designated medical staff. The extension of the value proposition has required the use of additional key resources such as centralised monitoring systems and specialised modems for patients: these led to an increase in cost structure. The costs of the service are divided into two parts: capital and revenue. There is some capital expenditure in setting up the service and purchasing hardware; then there is the expense of maintaining the service and the process of dealing with patients proactively. However, the service has become sustainable through cost reduction on the payer side, and service improvement and diversification on the provider side.[78]

Impact analysis

The objective of this section is to identify the benefits associated with the changes in the business models underlying the delivery of this diabetes monitoring system targeted at children.

[78] Interview with Dr Peter Hindmarsh, Professor at Great Ormond Street Hospital, June 2009 (see also: http://www.capgemini.com/industries/healthcare).

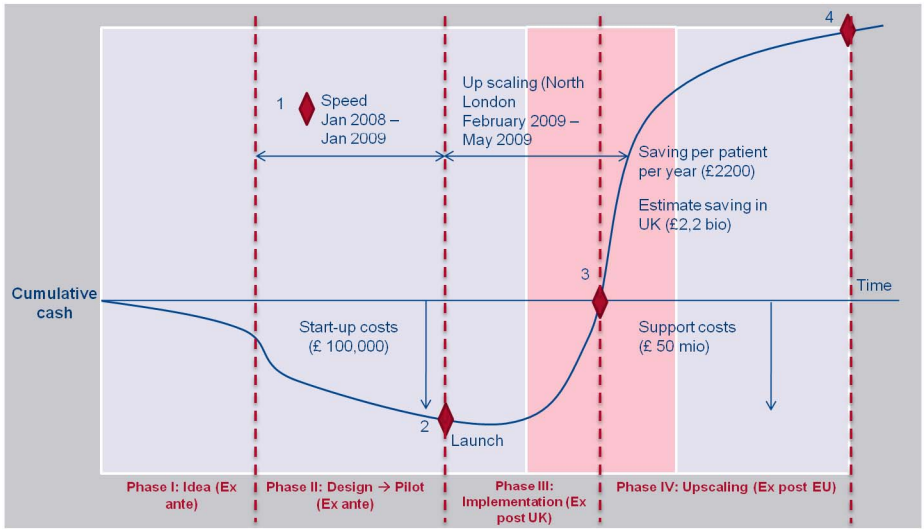
Internal benefits

One of the major benefits for UCLH is the increased granularity on data. Usually clinicians have to rely on a measure known as HbA1c (glycated haemoglobin). This is an average measure overfour to six weeks; it does not give the highs and the lows that are so important in monitoring this health condition. The data gathered via this eHealth system is more accurate, since it also measures important hypoglycaemic and hyperglycaemic episodes on a regular basis.

The system promotes improvement in the quality of patient data received by healthcare professionals. Earlier, they had to rely on paper charts that children or their parents had to maintain. Where results existed, often they were not clear and did not provide an easy way to extract trends or series, to understand the evolution of the condition over a period of time. The introduction of the system has changed this state of affairs by improving data availability and immediacy. The specialised nurse or clinician can see a patient's results as soon as they are uploaded, often on a weekly basis. This enables the identification of possible interventions.

The case of UCLH has some interesting benefits for the treatment of young diabetics. In general, it has been possible to witness increased patient proactivity in managing their chronic condition, with less time devoted to consultation with healthcare professionals. This is leading to a decrease of GBP1.75 million per year in cost for Primary Care Trusts. Should this system be scaled to rest of the UK, it is expected that it will generate savings of about GBP20 million in total.[79] Based on the available data, it has been possible to produce the following S-curve of the benefits as exemplified in the next figure .

Figure 18 S-curve of the UCLH case



Source: Adapted from Giesen et al. (forthcoming)

[79] Capgemini UK Analysis.

At this moment, the front-end monitoring system costs about GBP100,000. This includes iMetrikus hardware and software, and Capgemini's system integration support. The variable costs per patient were indicated at GBP5–10 per month.[80]

External benefits

This system dominates in terms of service innovation and associated quality of care, especially in terms of immediacy. Normally, interventions in the treatment of diabetes took six to seven weeks (because the nurse or clinician gained insight into the blood glucose levels at these durations), whereas now they can actually monitor the day-to-day health status of the patient. This increased amount of information means better and more focused care, which in turn means fewer hypoglycaemia and hyperglycaemia patients, and lower average blood glucose in patients. The result of this is fewer acute escalations and complications in patients, and less money spent on their care.

Best practice identification

It is possible to identify the following best practice from this case study.

- The first fundamental element of this system starts with the establishment of a consortium of partners sharing the same commitment to the success of the project, and at the same time, respecting each other's professional and operational role.
- The project benefited from strong senior management leadership by Professor Peter Hindmarsh throughout the entire development and implementation phase. He had a clear understanding of the specific needs of his patients and was committed to devising an IT application that could assist them in their care. This resulted in clear technical and organisational guidance to the technical members of the consortium: Capgemini and iMetrikus.
- The development of the systems saw the continuous involvement of all clinicians, who were clearly informed on the way that the new tool would change their operational activities.
- This engagement required the implementation of tight feedback sessions and enhancement cycles. Finally, all involved clinicians were provided with comprehensive training on the specific technical functionalities of the system and its data visualisation tools.
- It is important to emphasise that the development and implementation of the system is underpinned by repetitive quantitative and qualitative evaluation cycles. This facilitates regular performance evaluation of the system and identification of potential organisation and technical corrective actions.
- The sustainability was achieved primarily through the large savings achieved in treating individual patients. At this point, the objective is to roll out the system to cover the entire UK, which would lead eventually to even higher savings.

3.2.5 Naviva

Situational overview

The Dutch healthcare sector is extremely competitive in light of its free market approach: healthcare delivery organisations compete to provide the best quality of care at declining costs. Health insurance companies are one of the main beneficiaries of this approach, together with patients who can experience better quality of care, information and more

[80] Interview with Anneke Dantuma, Manager, Quality and Organisation at Naviva, May 2009.

process transparency.[81] This is the environment within which Naviva operates. Naviva is an organisation in the eastern region of the Netherlands aimed at delivering high-quality maternity care to pregnant women. It performs 10,000 units of care per year, which leads to a market share of 70% in this area. Naviva's core competencies are its quality of care, regional presence and operational partnerships.

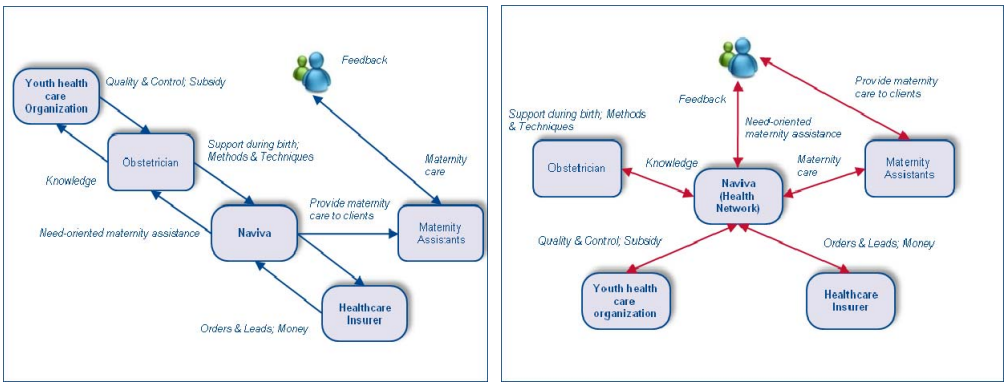
The evolving nature of the Dutch healthcare system has had an impact on the operational focus and financial revenues of the organisation. Naviva has noticed a decline in the number of patients using its services, causing a related decline in revenue. As it was looking for new ways to offer its services, Naviva considered IT as a way to facilitate direct contact with its patients by going beyond mere exchanges with maternity assistants. Together with De Waarden, another Dutch maternity care organisation, Naviva developed an online platform to support its patients electronically and to facilitate data exchange with individual actors involved in the value chain, such as health insurance, obstetricians and maternity assistants. In particular, the system entails the following elements:

- a web portal for clients;
- connection with ISK (national organisation for maternity care);
- data-sharing through IT applications between Naviva, De Waarden, obstetricians, and maternity assistants.

Value chain

The network and partners in both the healthcare value chain and the eHealth value chain – are visualised in next figure.

Figure 19 Naviva value chain (pre- and post)



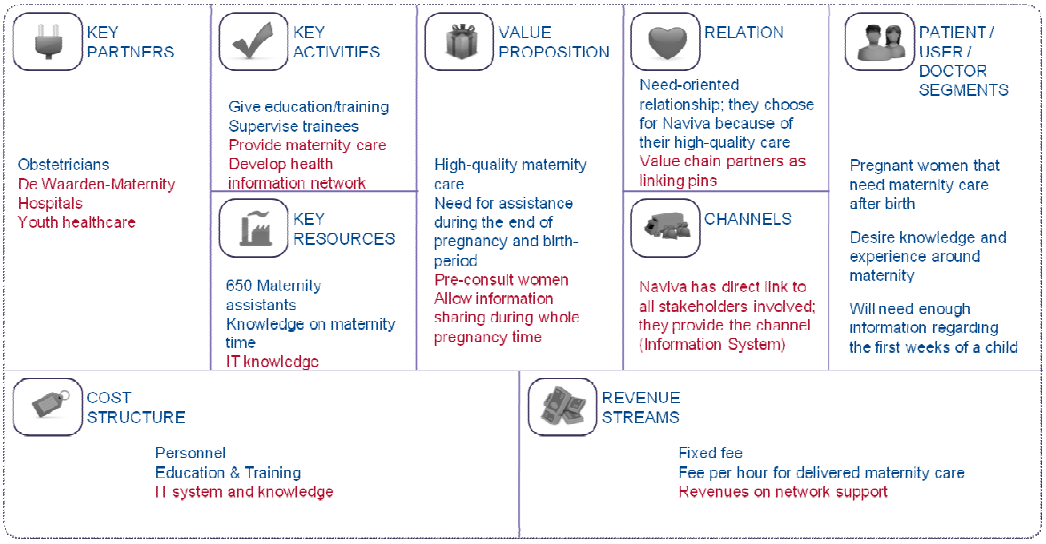
These diagrams describe how the introduction of Naviva has changed the delivery of its services. Prior to its introduction, Naviva was interacting only with maternity assistants who were collecting specific needs from patients and passing them on to the health insurers, local and national authorities and, where applicable, obstetricians. The new online platform has changed this state of affairs. While patients can still interact with maternity assistants in face-to-face meetings, they can ask for electronic consultation and support via the new online platform for a different fee. This also integrates all the other actors and shares information among them, cutting down on processing costs and related inefficiencies.

[81] Interview with Anneke Dantuma.

Business model analysis

The following image provides an overview of the changes in Naviva's business model following introduction of the online platform.

Figure 20 Naviva's business model



NB: Red text indicates changes brought by the introduction of the eHealth system

The new electronic platform has extended the number of key partners coordinated by Naviva, thanks to the direct involvement of De Waarden as a service provider, hospital obstetricians and youth organisations with their policy development around maternity assistance. Moreover, its key activities were extended, since they provide assistance in maternity care both online and offline and general background information and data. The value proposition was extended because Naviva is now able to provide assistance to women during all the phases of pregnancy, especially in the initial period. In fact, prior to the introduction of the online platform, Naviva was providing support primarily during the last one to two weeks prior to and after the birth of the child.

The online platform has allowed for an increase in clients, since non-pregnant woman can access pregnancy-related information and data about pregnancy. It is expected that these women will resort to Naviva should they get pregnant, and therefore bring additional revenue to offset the additional costs in IT and network support.

Impact analysis

The following two sections provide an overview of the internal and external benefits associated with introduction of the new online platform.

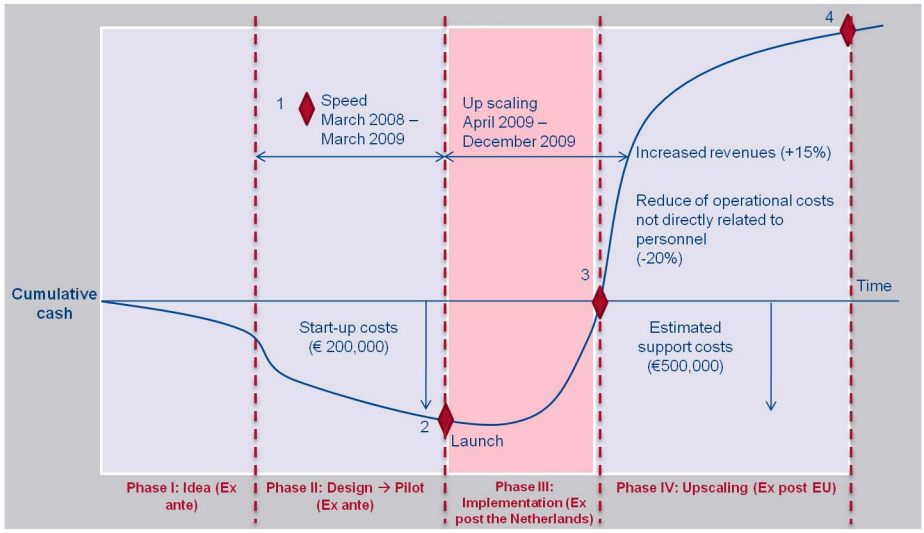
Internal benefits

Following the delivery of the online platform, Naviva has chosen a different focus for its services. It moved away from being an exclusive maternity care provider and transformed itself into a complete maternity care network provider. This does not mean that it has abandoned the provision of treatments – its maternity care assistants still play an important role in assisting women who are pregnant or have just delivered a baby. Face-to-face interactions are still needed. The platform has added an extra dimension to maternity care by trying to assist women during the entire pregnancy period. Moreover, in light of its direct links with health authorities and insurers, it has digitised exchange of the relevant

documentation, leading to gains in process efficiency. Internal company data has valued these gains at a 25% decrease in administrative costs. Based on Naviva's in-house research of a group of 2,500 patients, further indications were given that there is a decrease of 10% related to reduction in costs for maternity assistants, and a decrease of 25% in terms of training and educating personnel, because this is provided adequately by the web-based service.

In order to achieve these benefits, Naviva has invested EUR200,000 and a similar amount has been contributed by De Waarden. Currently, Naviva is examining the possibility of extending its services to other target groups. Based on this information, it has been possible to extract the relevant S-curve.

Figure 21 S-curve of the Naviva case



Source: Adapted from Giesen et al. (forthcoming)

The development of the IT service required an investment of EUR500,000. This is a large effort for Naviva but, as the figure indicates, the service already has generated an increase of 15% in Naviva's revenues, and a decrease of 20% in operational costs. With the profit gained, it is able to pay the estimated support costs, thus Naviva has been able to upscale its service, increase the number of patients that it serves, increase services to patients and gain valuable information regarding its stakeholders in the value chain, by adding IT services into its maternity care.

External benefits

The new value propositions resulted in pregnant women receiving better accessibility to support, better preparation for their situation and, most importantly, improvements in the well-being of the women and children. Naviva dominates on experience, since it provides pregnant women with a more comprehensive set of services. Naviva is already in the higher segment of maternity care, and it has been able to achieve satisfaction for more patients through the portal.[82] Of the people that use the web portal alongside traditional maternity care, 98% of the pregnant women are satisfied. Moreover, Naviva has embarked on a new way of informing pregnant women and women who are searching for information regarding pregnancy. Therefore, Naviva can reach people who were never usual patients at that time.

[82] Interview with Anneke Dantuma.

In addition, Naviva has identified another benefit: more transparency in the maternity care value chain. Normally, the value chain is fuzzy and has no direct specific lines to the different actors involved. However, since other parties are connected, it creates more awareness for the different actors involved about what is actually happening within this value chain. This eventually leads to a higher awareness about what is done primarily by each actor, and in what way they can cooperate in order to increase the value of care.

Best practice identification

From this case study it is possible to extract a set of best practice for the development of eHealth systems.

- One best practice of Naviva's eHealth service is the focus on using an online platform to create a network of partners committed to devising new ways to support women during their entire pregnancy.
- Naviva guided the technological implementation to achieve this objective, and provided De Waarden with clear specifications concerning the required technical and operational functionalities. This allowed Naviva to focus on engaging all the involved stakeholders, including back-office staff, in monthly training and feedback sessions.
- Naviva monitored the operational results of the project through the development and implementation phase, by evaluating the performance of the new service. Its results were monitored frequently, and were followed up with tight feedback sessions and enhancement cycles.

Naviva believes that its system is now sustainable, since it has led to internal operational efficiencies while providing new services to pregnant women. It has seen an increase in the number of women using the new services. Naviva also believes that its model can be used in other European countries, when provision for language customisation is enabled.

3.3 Concluding remarks

In the previous paragraphs, this chapter has introduced five illustrative case studies of eHealth systems that currently are delivering value to its users and are sustainable. A specific set of lessons and guidelines have been identified for each case study. The results of this examination, combined with the evidence presented in the previous two chapters, provides the basis for the next chapter, which will provide operational best practice supporting the development of value-creating business models in the area of eHealth, and public policy interventions for supporting this objective.

CHAPTER 4 Defining a vision for value-creating eHealth systems

In the previous chapters this report has argued that value-creating and sustainable eHealth systems involve the development and implementation of business models where processes and stakeholders' interactions are mapped and identified. In addition, it has argued that, unlike other commercial environments, identifying value creation and sustainability in eHealth requires taking financial and non-financial factors into consideration. These arguments have been tested via five illustrative case studies from which some specific operational guidelines have been extracted. In this chapter, the report brings together the analysis of the previous chapters by providing a set of strategic guidelines for the development of business models supporting value-creating eHealth systems in Europe, and indicating a set of European public policy actions to support their implementation.

4.1 Value-creating business models for eHealth: a set of strategic guidelines

The following paragraphs provide an overview of a set of strategic guidelines to support the development and implementation of a value creating eHealth system. The first main conclusion from the analysis of the collected evidence is the pivotal importance of senior management commitment to devise an eHealth system that does not substitute a pre-existing healthcare service but improves it, and allows for extracting additional value. The starting point for this is mapping the business model to support a specific healthcare case and the way that introducing ICT can improve this. This is particularly evident in two specific case studies, Naviva and Tactus systems, where senior management looked specifically at IT in order to improve the quality of their services and exploit other potential commercial and operational venues. However, this mapping process is not always explicit. In the case of CUP, senior management aimed to facilitate the overall booking of specialist tests and visits to all Umbrian citizens. A similar situation applies to Telemedescape and UCLH telemedicine system. Irrespective of the explicit or implicit approach, the examined literature and case studies suggest that the introduction of IT systems has led senior management to ponder the possibility of using ICT to go beyond delivery of the specific healthcare service that they were targeting initially. They began to consider new services or functionalities via integration with other systems. This was evident in the cases of Tactive and Naviva, where senior management identified additional financial revenue by extending their service offering. In the case of Telemedescape, the system was considered to be the first step towards a local or regional electronic patient record system involving diagnostic centres, hospitals, GPs and pharmacies. In the case of

CUP, senior management viewed IT as a way to engage all stakeholders while providing additional revenue to pharmacies. However, in all five cases, it was evident that senior management had to redesign the business model so as to accommodate these new potentialities.

This confirms what the literature has indicated clearly: that business models supporting a value-creating and sustainable eHealth system are not a static entity. They need to be dynamic in order to exploit the potential new benefits brought about by an eHealth system and its future developments. In this context, senior management commitment is particularly important when several network partners are involved or affected by the introduction of an eHealth system. Their engagement has to be examined and jointly assessed and, where possible, tested, since an eHealth system requires strong commitment from all the involved actors. Therefore, a business model needs to be flexible and adaptable to new situations while avoiding a 'Big Bang' approach. It needs to apply a phased step-by-step approach so that all involved actors have the time to adjust and adapt.

The sustainability and value creation of an eHealth system also requires stable financial support for its implementation. As argued in the previous chapters, this specific element is essential, since implementing eHealth systems involves a long time before they return the expected operational and financial results. This specific element was evident in the case of Telemedescape, whose functionalities have evolved over the years. Senior management was instrumental in making sure that the activity received constant funding, which helped to avoid development gaps. In the other case studies, the systems involved less time for implementation, but regular funding was made available. However, as already argued in the examined literature, the quest for funding commitment should not be exclusively for covering the costs associated with IT development and implementation; it is also important to allocate funding to cover staff time for their involvement in the change management processes associated with introducing a specific eHealth system.

The business model of a sustainable eHealth system needs to refer to a clear understanding of the needs of patients and involved healthcare professionals. All the case studies, in fact, had a clear and precise understanding of the specific needs of their patients. Their goal was to add value and not to create additional burdens, hence the need to directly or indirectly involve them in designing the functionalities. However, this is not an easy task, since specific needs evolve over time. This calls for the development of an operational process for capturing these evolving needs while finding appropriate responses and solutions.

As emphasised in the literature and the five illustrative case studies, it is clear that the technical infrastructure of value-creating eHealth systems needs to be based on open standards and applications (which does not mean open source software). It is necessary to use technical hardware and software solutions that allow easy integration with current and future systems. This approach is particularly evident in the specific case of Telemedescape, where integration was achieved with the use of HLS version 7 communication protocols. Similarly, in the case of CUP, the system was developed in such a way as to ensure usability by pharmacies.

Claiming that an eHealth system and its underlying business model are value-creating is not the same as being able to prove it. As indicated in the opening pages of this report, the available literature provides unclear tested guidance in actually quantifying or qualifying the benefits achieved with the introduction of an eHealth system. Still, the case studies shared the common element of implementing regular operational assessments while the system was developed or delivered. In all five cases in particular, there were regular in-house sessions to review the performance of their services. In the case of CUP, this

performance was monitored regularly by tracking transaction numbers. However, the most visible example of performance assessment is exemplified by Telemedescape: here, senior management decided to go outside their organisation by procuring independent evaluation. More importantly, the assessment was not only targeted at measuring and evaluating internal benefits of the system; effort was directed also towards quantifying the external benefits, an operational approach that is in line with the overall argument of this report – that a business model of a value-creating and sustainable eHealth system should be measured not only in financial terms, but also in socio-economic ones.

In the previous paragraphs this chapter has provided a set of strategic guidelines that healthcare delivery organisations should tailor and operationalise via detailed checklists in their specific settings. Nevertheless, their operationalisation should be supported by appropriate public policy initiatives and actions performed at the national and European level.

4.2 Policy recommendations for fostering positive eHealth business models

eHealth systems can provide responses to Europe's changing demographics, disease patterns and overarching healthcare capabilities. Provided that its potential is fully exploited, it can help to deliver better care for less money while fostering technological innovation. At the same time, European industry as a whole can provide responses and solutions, especially since it can leverage the experience and knowledge of other fields such as pharmaceuticals and medical devices. Still, these benefits can be achieved only if eHealth systems deliver on their expected value and sustainability. In addition to applying specific operational guidelines, there is also a need for public policy initiatives supporting the development of value-creating business models for eHealth. These require the involvement of all stakeholders such as national healthcare authorities, health professional associations, healthcare delivery organisations, industry and the research community as well as European perspectives, so as to foster the sharing of applicable best practices and experiences.

A first potential initiative should be to launch pilot actions of eHealth-related projects where different business models are tested or simulated using appropriate modelling approaches. This may require operational data to be collected from current or planned systems and examined in detail. EU Framework Programme (FP) 7 and similar initiatives can provide a good environment for implementing this initiative. Currently, under the aegis of the Competitiveness and Innovation Programme – ICT Policy Support Programme, the European Commission is working towards the deployment of eHealth records between 12 EU Member States. At the same time, it is bringing together the large majority of national health authorities to foster a road map for pan-European exchange of patient information. These activities, as well as those expected to be supported via future calls, can provide a solid basis from which different organisations can share detailed information about the business models supporting their national and (where applicable) pan-European eHealth systems. The sharing of business modelling experience *per se* only provides limited responses. It is important that specific benchmarking parameters are identified so as to ensure that individual organisations are able to monitor and compare the way that they develop and implement business models for eHealth. As with the previous initiative, this initiative requires a more targeted pan-European approach that

goes beyond the current European Commission's attention to identify indicators for assessing the specific level of eHealth implementation in Europe.

Irrespective of the tactical initiatives indicated in the previous paragraphs, developing business models for value-creating eHealth systems involves the exchange of specific best practice and practical experience from organisations which have actually gone that way. In this context, particular attention should be directed to knowledge about funding mechanisms and responses to national legal challenges. Although it is clear that EU Member States embody different healthcare financial models, organisations may face similar challenges in dealing with start-up and operational funding. Therefore, it might be very beneficial for healthcare delivery organisations and national public health authorities to see how their colleagues have managed interactions with national and international financial institutions to secure the required funding. As for the previous suggested initiatives, it might be useful for this activity to be managed and coordinated by the European Commission in the context of its current activities associated with structural funds, but with the support of specialised agencies such as, for example, the European Investment Bank and its activities related to managing structural funds.

Similar information-sharing and best practice identification should involve specific topics such as security, privacy, data protection and safety. Usually the elements are solved with appropriate regulations and protocols; however, it is important to remember that these requirements are often neglected when designing and developing a business model for an eHealth system. At the same time, some of the issues associated with privacy and security may be overemphasised. Therefore, knowledge exchange is essential on how different organisations have addressed these specific elements when beginning to design and map the supporting business model of an eHealth system. Unlike what has been indicated previously, there is already quite a significant amount of data and information available on where to begin. What is required is a coordinated central point where this specific knowledge and experience is collected, organised and made available to all interested stakeholders. As with the previous suggested initiatives, this activity should be led by the European Commission and involve stakeholders including legal counsellors and the chief technology officers of healthcare delivery organisations.

The proposed initiatives primarily have a national focus, in the sense that they are aimed at fostering the pan-European exchange of domestic activities. However, the situation becomes more complex when the analysis is extended to consider multinational eHealth systems. In these cases, the guidelines previously identified are valid and their implementation should lead to identifying and structuring appropriate and detailed business models. Nonetheless, these business models may not provide the necessary positive responses in light of the current technological, financial and legal divergences among Member States. This should not prevent national authorities and healthcare delivery organisations from different countries from working together to find common solutions and appropriate business models using the current research and development funding mechanisms provided by the European Commission, or reporting back in terms of best practice and knowledge-sharing with their peers from other EU states.

This chapter (and the report overall) does not pretend to be comprehensive in its analysis and conclusions, as it deals with a constantly evolving field as new technological solutions constantly arise. Nevertheless, its ambition is to foster a stream of successive research activities aimed at consolidating its findings and providing new business model responses to healthcare organisations that want to continue to venture in this field, exploiting the potentials of the internet and new ICTs.

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Annex 1: Expert interviews

As part of evidence collection, the project team undertook a set of semi-structured interviews with leading European experts on eHealth. Each interview was conducted to strict Chatham House rules, and the interviewee participated in a strictly personal capacity.

Country	Service/company name	Position	Title	Name	Date of interview
UK	eHealth Interdisciplinary Group	Senior Lecturer, Leader of the eHealth Interdisciplinary Group	Dr	Claudia Pagliari	23.4.2009
UK	Judge School of Management, University of Cambridge	Professor	Prof.	Stefan Scholtes	7.5.2009
IT	Bocconi University	Professor and Head of eHealth	Prof.	Luca Buccoliero	11.5.2009
BE	European Venture Capital Organisation		Mr	Georges Noël	14.5.2009
FR	AGFA-Healthcare	Director, Strategy	Mr	Eric Maurincomme	15.5.2009
UK	Brtish Telecom	Director of Health, EMEA and Latin America	Mr	Keith J. Rivers	15.5.2009
NL	Plexus		Dr	Jaap Maljers	18.5.2009
CY	DITIS	Associate Professor, Department of Computer Science, University of Cyprus)	Prof.	Andreas Pitsillides	18.5.2009
NL	Pfizer	eHealth Manager	Mr	Gerard Davelaar	19.5.2009
NL	Menzis	Manager, Innovation and Healthcare	Dr	Harry Nienhuis	20.5.2009
BU	Ministry of Health, Bulgaria	Deputy Minister for Health	Dr	Lubomir Pramatarov	22.5.2009
Benelux	Microsoft Amalga and Health Vault	Manager, Healthcare, Microsoft Benelux	Dr	José Strijbos	26.5.2009
NL	KPN	Healthcare Manager	Ing.	Ruud Slemmer	26.5.2009
BE	Intel	Digital Health Policy	Dr	Mario Romao	27.5.2009

		Manager			
BU	Consortium (ICW–Cisco–Kontrax)	Health care Business Manager	Dr	Dimitri Trifonov	27.5.2009
CZ	General Electric	General Manager, Home Health	Mrs	Agnes Berzsenyi	28.5.2009
UK	NHS Scotland: eHealth/Scottish Care Information Gateway	Chair, Scottish Care Information Gateway Steering Group, and Scottish Executive eHealth Directorate	Mrs	Jackie Caldwell	28.5.2009
NO	Norwegian Center for Telemedicine	Head	Mr	Steiner Pedersen	29.5.2009
NL	Martini Hospital	Cardiologist	Dr	René van Dijk	2.6.2009
NL	Catharina Hospital	Anaesthetist	Prof. Dr	Erik Korsten	2.6.2009
NL	Federation of Patients and Consumer Organisations in the Netherlands (NPCF)	Senior Policy Employee	Dr	Marcel Heldoorn	3.6.2009
NL	University of Amsterdam	Professor, Medical IT	Prof. Dr	Arie Hasman	5.6.2009
NL	Rivas Zorggroep	Information Manager	Mr	Peter Smithjes	8.6.2009
NL/GE	Siemens	Manager, Health IT	Dr	Eva Remerie	25.6.2009

Annex 2: Case study on selection methodology

This annex details the methodology for the selection of the five illustrative case studies described in the report.

The research methodology scholar Robert Yin encourages the use of case studies for public policy projects when they discuss situations and environments that the researcher cannot manipulate, or those in which the researcher does not have intrinsic and direct involvement.[83] The overall objective of this project satisfies these two requirements, since it aims to identify case studies of value-creating and sustainable eHealth systems in Europe from which it is possible to extract relevant best practice and guidelines. Having favoured this specific research methodology, the first research challenge was to choose between an approach involving the analysis of a single case study, or one centred on multiple ones.

Yin argues that research strategies based on one case study are suitable in three situations. First, they should be undertaken when the selected case study represents events or situations that may test a well-established theory by confirming its strengths or introducing alternative explanations. Second, this research strategy may be used when the case study is unique, rare and, more importantly, revelatory. Third, this condition exists when 'the investigator has the opportunity to observe and analyse a phenomenon previously inaccessible to scientific investigation'. Even if these three conditions are satisfied, this strategy presents the risk that the selected case study will not be sufficiently explanatory. Consequently, Yin suggests avoiding single case study strategies 'until all major concerns have been covered' and, in particular, total access to all the required quantitative and qualitative data for conducting the analysis.

This project team has not been able to identify a single case study that fulfilled the necessary criteria and provided indispensable data and information from which applicable operational best practice applicable to all European eHealth contexts could be extracted. Instead, it was possible to identify several case study candidates that would have suited a multiple case study project. In fact, multiple case study projects are considered to be more robust, since they are able to present more compelling evidence. Selecting this research strategy opens up a set of specific research challenges, primarily accessing the required evidence and the need to select case studies allowing for 'logic replication'. This is the situation where each case study 'either (a) predicts similar results (a literal replication) or (b) produces contrary results but for predictable reasons (a theoretical replication)'. In order to satisfy the requirement for logical replication, each case study needs to refer back

[83] Yin, R. *Case study research: design and methods* (3rd edn). Thousand Oaks, CA, Sage Publications, 2003.

to the proposed operational framework and unit of analysis. Their precise identification is extremely delicate, since it may affect the possibility to extract relevant and comparable information and data. Units of analysis guide the research project and data collection. If the questions and objectives of the project do not reflect the units of analysis, the collected data will not provide the necessary evidence from which to extract meaningful and solid conclusions.

Taking into consideration the strategic objectives of this project, it was decided to espouse a multiple case study approach. Therefore, efforts were directed towards identifying and selecting cases that would allow for logical literal replication. These were expected to be sustainable eHealth systems (units of analysis) that were fully operational and integrated in the overall delivery of a specific healthcare-related service (e.g. medical advice or test results delivery). In addition, they were expected to be supported by a revenue model that makes them chargeable, in line with the *modus operandi* of the national health system where they operate. Satisfying these conditions was extremely important, since the literature makes extensive reference to eHealth systems that seem fully operational but, after closer examination, are actually still in their pilot phase.

In addition to the condition of sustainability, particular attention was directed towards identifying case studies that allowed access to the necessary qualitative and quantitative evidence. The third selection criteria referred to the fact that the combination of case studies was suitable to provide for the coverage of each of the four eHealth sectors identified by the European Commission in its Lead Market Initiative. Finally, the selected case studies should not have been examined by previous EU-supported projects. The satisfaction of all of these criteria led to the selection of the five case studies described in the report.

Annex 3: Validation workshop

The initial results of the project were presented during a half day restricted workshop held in Brussels on July 7, 2009. During the workshop, the project team presented the first results of the project and collected suggestions for future directions for the project. As in the case of the expert interviews, participation in this workshop was under strict Chatham House rules and in a personal capacity. The workshop participants are listed below.

- Dr Hans Ossebaard, Senior Research Fellow, University of Twente
- Keith J. Rivers, Head of Healthcare, EMEA and Latin America, British Telecom
- Hans Keizer, General Manager, Tactive
- Chloé Manificat, Consultant, Alcmend
- Anne-Charlotte Pupin, Project Manager, Alcmend
- Roberto Landi, Assistant Professor, Libera Università delle Scienze Sociali, Italy and Coordinator, eHealth Executive Master's Programme, Luiss Business School
- Liuska Sanna, Programme Officer, European Patients' Forum
- Fabio Miraglia, Professor of Healthcare Management, Università Mediterranea di Reggio Calabria
- Paul Garassus, Official Delegate, Union Européenne de l'Hospitalisation Privée
- Mario Romao, Digital Health Policy Manager, Intel Corporation, SA
- Harry Nienhuis, Innovation Manager, Menzis

Annex 4: Final workshop

This annex provides a description of the methodological approach for the final workshop structured around the active scenario methodology held in Brussels on November 8, 2009. The following paragraphs provide an overview of the overall workshop approach and the list of participants. The results of the workshop have been one of the core inputs to identifying future EU public policy interventions for fostering value-creating and sustainable eHealth systems and applications in Europe.

Workshop methodological approach

The objective of this workshop was to discuss the preliminary version of the final findings of the project and identify future policy interventions for fostering the development of business models for sustainable and value-creating business models for eHealth. The core element of the workshop was application of the active scenario methodology. This approach, which has been approved by the European Commission, builds on the fact that scenarios concerning future developments of specific services or systems should be devised with the direct involvement of the involved stakeholders. The stakeholders should be in a position to freely express their ideas based on their specific personal and professional experience. The results of these expressions were collected and jointly presented during a scenario-based workshop and used as a starting point for moderated discussions among invited workshop participants.

With the European Commission's support and approval, RAND Europe and Capgemini Consulting implemented this methodology in the final workshop of this project. This required them to conduct two-minute interviews with healthcare professionals from different EU countries. In selecting the interview participants, RAND Europe and Capgemini Consulting focused on healthcare professionals who are actively using (or expect to use) eHealth applications. However, the project team also wanted to identify interview targets who are not regularly involved in the overall European eHealth public policy debates. The reason for this restriction is that RAND Europe and Capgemini Consulting were interested in getting information about and perceptions of the ways that eHealth is currently changing their professional activities and future directions, without contamination from current EU public policy intricacies.

RAND Europe and Capgemini were able to obtain agreement for a video interview from eight European healthcare practitioners and patients. Each interview lasted between two and three minutes, and the participants were allowed to respond freely to the following two questions:

- What kind of eHealth system would you like to see on the market?

- How would you benefit from it?

The interview participants were asked to be frank and independent in their assessment. In order to preserve a sense of spontaneity, the interviews were taped live and left unedited. Some of the participants prepared brief background notes to facilitate their communication in English, which was not their mother tongue.

Having completed the interviews, the project team merged them into a single digital video file to be presented at the workshop. Since the workshop participants had different linguistic backgrounds, it was decided to transcribe these interviews in order to facilitate comprehension.

The workshop itself lasted one day, and was hosted by the European Commission in Brussels on November 9, 2009. The meeting opened with introductory remarks from the project team and the European Commission, including an overview of the results of the project up to that stage. Afterwards, the workshop participants were presented with the digital video file of the interviews, then asked for some immediate first reactions.

The participants were then subdivided into two groups and engaged in the first breakout session, where they were asked to discuss the following question: 'Why are eHealth systems not successfully responding to the needs or expectations of the interviewee?' The participants were asked to identify these reasons using sticky notes to attach to the wall around the room. These sessions were moderated in order to facilitate participants' engagement and to support the clustering of issues along common themes and/or trends. Following lunch, each breakout group was asked to report back to all the participants in the plenary sessions, where all the participants were asked to comment and debate.

Starting from the results of the morning discussions, the participants were asked to break for the second session in order to discuss and identify actions to overcome the barriers or impending factors affecting the development of appropriate business models. As with the morning session, this identification process involved a facilitated debate on the generation of recommendations across stakeholders. Each participant was asked to identify public policy options involving the European Commission, Member States and other stakeholders. These ideas were posted on sticky notes.

The same approach of the morning session was followed subsequently: a moderator was asked to consider each suggestion and steer the discussion to determine what policy actions are necessary to support or encourage the required actions by each class of stakeholders. For example, the participants might identify that 'business needs to adhere to common interoperability standards regarding message exchange for the sharing of electronic patient records'. The recommendation (and the ultimate aim of what is to be achieved) could be an understanding of what the policymaker (and which sort – the European Commission or Member State) needs to do to encourage, support or facilitate this. In the above example it might be: 'Policymakers should require IT common standards for managing the sharing of personal healthcare records in Europe.' As in the morning session, a clustering process was implemented.

The results of the discussions were reported back to the plenary by the nominated *rapporteur*. The floor was then available for a moderated discussion.

Workshop participants

- Björn Kabisch, Jena University Hospital
- Bruce Greenstein, Health Microsoft

- Hans Ossenbard, National Institute for Public Health and the Environment, Netherlands
- Helen Westendorp, Tactive (eHealth free of alcohol)
- Ivana Silva, Pharmaceutical Group of the European Union
- Keith J. Rivers, BT Global Services
- Mike Palmer, ICT for Health unit (H1), DG Information Society and Media (DG INFSO)
- Philippe Swennen, International Association of Mutual Benefit Societies
- Veronique Lessens, Agfa HealthCare and COCIR HC IT
- Virginia Braunstein, Economic and Statistical Analysis unit (INFSO C4)
- Christoph Thuemmler, School of Computing Edinburgh, Napier University
- Harry Nienhuis, Menzis
- Kristin Smith, BT Global Services
- Lisette Van Gemert-Pijnen, eHealth Research Center, University of Twente
- Liuska Sanna, European Patient Forum
- Mario Romao, Intel
- Nigel Strang , DG Info, European Commission
- Octavian Purcarea, Health Microsoft
- Saad Mezzour, Medtronic

Active scenario interview transcripts

The following paragraphs provide transcripts of the stakeholder interviews described previously. This text has not been edited to preserve the original sentiment and feelings of the participant.

Francesca, pharmacist, Italy

'Hi, my name is Francesca Duranti. I am currently following the tradition of my family who has owned a pharmacy in the centre of Perugia over the last 100 years. I have actually been a pharmacist since 1995, but I have been here since I was a child. I like my job since I can talk to my people and help them, so I feel I am an active member of my community. I am not a great user of IT systems. In Italy we have an IT system called Centro Unico di Prenotazione. Patients come to the pharmacy to make an electronic appointment for a visit or test. I enter the electronic database and book the visit according to availability, and then I collect the ticket as requested by the visit and test. It is very useful for me, since patients can buy other medicines while making an appointment. I also know about RFID. These are specific sensors that make sure that medicines we sell to the people are not fake, because over the last six and more months fake medicines have been available at pharmacies. So with RFID I can see where it is bought and that it is not a fake medicine and can give it to the patient with no problem. IT can be useful for my work, but at the moment it is not really changing my life. '

Diederik, chronic diabetes patient, the Netherlands

What kind of eHealth system would you like to see on the market?

'My name is Diederik and I am an urban development designer in the Netherlands. For six months, I have had diabetes. This means that I have to check my blood glucose five times a day, and have to inject lots of insulin. I write down these values into a booklet. Every six weeks I go to the hospital to discuss the values with my doctor and nurse. They look at the

booklet and adjust the amounts of insulin based on the values of the last six weeks. Unfortunately, they can only check my values once during these six weeks. IT systems could help me with my disease. When I have a system at home, linked to my computer, I can easily write down my values and send them on a regular basis to the hospital. It can be a system which also indicates the amount of insulin I have to inject when I have high blood glucose levels.'

How would you benefit from it?

'These systems can be very useful in gaining control over my diabetes. When I have the ability to put values into a system, these can be analysed easily by my doctor. She can tell me more often what adjustments I need to make in injecting insulin, so the fluctuation in my blood glucose will decrease. I will have less chance of complications resulting from diabetes. For example, I need to go less to the hospital, and have fewer hypos (<4) and hypers (>20). The result is that I will feel much better during the day.'

Gabriele, insurance broker, Italy

'Hello, I'm Gabriele Lasci, I'm an insurance broker in Umbria. Following recent changes in Italy's legislation, I am actually able to sell many products from different providers. The client comes to me primarily for life insurance and professional indemnity. Over the last years there has been an increase in requests for private health insurance. You know, in Italy we have a health system, a national health system, but [this] national system is not … so good. You know, it is not that bad, but you know… they can't wait for that. You ask me about the eHealth system we would like to see in the market… You know, even if the prices are not good for my clients, they are good for a lot of effort, so in general it's not helping me and the insurance I work for. You know, because for example, when an individual comes to me for insurance, it would be useful for me to have some information about his [or her] healthcare in general, so they would be much faster and there will be fewer mistakes. So that would be better for me as insurance broker and for the insurance as well. You know I am not very knowledgeable about eHealth, but in general I saw something in the past. I saw something in the hospital as well, because they had some database, they check the patients' records on a database – that would be very useful for me, even if I'm not expert in eHealth. What about… you ask me about the benefit from eHealth? I think this new IT tool in healthcare, to select, can be very useful for the organisation I represent as well. For example, you can have information as to what your previous condition was, whether you smoke or not – you already have this information, you can check it on your computer, it will be very very very easier to work. And also if, if I be[come] … a patient I'll be much more quite because I know that the people are checking my health on a database, so they already know my situation. The positive also, when we need to process a claim because, you know, now I have to check everything in paperwork. Everything in the future will be, I hope, will be done via the internet, so will be very much, you know, faster and easier.'

Helle, chronic patient, Denmark

'I just think that the idea sounds nice. I am not a doctor and I don't know anything about eHealth systems. So, if I was comfortable with it and was sure about it – like I am now, shopping on the internet. It would take some years. Then it would be perfect, if I could take my blood sample at home and just knowing it would be just as safe and just as quick and they could share information between different doctors. I think it would be most nicely, if every hospital doctor would communicate with each other. I don't think we are so far in that area, because … I live in Demark. And they [doctors] do sometimes communicate. It is going better and inside the hospital they do communicate, but they try

to communicate better with your own doctor. So that's good, and I think it is very necessary, and I can't see how it can be so complicated. It would be nice if they developed even more across countries. If I am injured in a foreign country and that's probably more … well, I guess I will have more problems. Eventually, if I feel safe about [it], I would like to take my own blood test and then just send it. Because I have epilepsy and I know exactly how to do it, there is no need for my doctor to use his very expensive time to do that for me. But I wouldn't like to miss the personal contact in total but if it is something I really know how to do, and it would only be a waste of time for me and the doctor, I don't the necessity of just going there. And of course, I think it's gonna take several years because I have to be very comfortable and thinking that the result will be just as good as if I went there in person. And so I wouldn't like my doctor to be just an online doctor. He has to see me and he has to, yeah, I don't know, if I am injured, see what the knee looks like. Even so with a webcam, if don't think it's the same. I would feel much more comfortable if he was there, but not in the common coincidence that I am used then this is totally ok. And it might be even quicker. I have one more thing, and I don't know if I am allowed to say it. But I don't think it ever gonna work unless the personal data policy is loosened up in the EU. I am sorry.'

Massimo, general practitioner, Italy

'Hi, my name is Massimo Alba. I am a GP here in Rome serving patients that are resident in the northern part of the city. I have been a GP for the past 12 years. I started outside Rome and then moved to the city after five years. I have a mixed set of patients; most of them are professionals and come from middle-class environments; clearly, I also have people with low incomes. I am confronted with the usual health conditions, some of them chronic. I am not a great user of IT. Yes, I have the internet in my practice and interact with my patients via email sometimes. However, I still like to have a face-to-face interaction. One possible IT system I would like to see is some sort of shared patient record. Currently, I have the medical history of my patients. Actually, I do not need the computer as I know most of them. Experience and knowledge is always important. However, it would be great to have the possibility of accessing electronic patient records to facilitate all the processes. For example, when a patient takes a test, I should be able to receive the results electronically so that I can see and take the appropriate measures. I would not need to actually see the patient unless it is extremely urgent. I know that I can do this. However, I can also see a major issue. Does this count as a visit? Do I get paid if I do this remotely? This is still not precise, but if in the future this can be done, it will be great, I suppose – as I said, I am not a great user of IT. However, with some of my colleagues I have been informed about so-called telemedicine services. These are expected to allow me to monitor a patient from a distance. Well, I am a GP and, in theory, it is difficult for me to monitor all the patients. However, I can see telemedicine for people with chronic diseases such as diabetes. If they can send the data to somewhere and I can monitor sometimes how they are doing, I can see the benefit. As you know, Rome has terrible traffic … so telemedicine can allow you to avoid it. Still, I am afraid of my patients' expectations. What happens if I am not able to see something via telemedicine? Am I responsible? I use the internet so I can see it in my work, but there are risks. Should I continue to use pen and paper?'

David, ER doctor, Germany

'I would like to have a PDA [personal digital assistant] that allows me to access my patients' records, manage my entries in real time, and consult key medical references and encyclopaedias. Also, I would like it to be equipped with a camera so that I can take photos which I can send to and share with my colleagues for immediate feedback. It must be easy

to use, comprehensive, networked, reliable and quick. However, I am afraid that more information will lead to an information overflow and make it more difficult to take fast decisions. Also, I am worried about the implications of using such a system – will it be used to make physicians more accountable and increase stress and burden? '

Sam, biomedical scientist, UK

'My name's Sam and I work for the NHS in Harlow. I'm a biomedical scientist, and I use the TG system to install patient information regarding histologen sectology. I find the systems quite helpful and easy to use. It's helpful because I can access any patient information that I need, from any computer around the lab, and that helps with my work, that makes my work a bit easier. Also means I don't need to keep paperwork everywhere because everything is being stored on the computer.

What ways do you think the lab could benefit from different sorts of IT, or better use of technology in your lab? As I said before, because you keep all the information in one place and everyone can access that, that happens with other systems within the hospital – like, if you have a blood test done, that it's available to the lab and also to the GPs, or to anyone that is authorised to have that information, so that means you don't need to send a letter to the GP, the GP can straightaway access the patient's results, discuss with the patient, so that facilitates a lot. Also, you can keep all the patient's details and paperwork within a file, in a computer, rather than have, you know, numerous files, and having to have a place for them and things. Do you think there are people in the lab that use IT in a … use IT well, are they IT literate in terms of how the sort of, processes, and all the paperwork that they do?

No. It's very difficult, especially for the older members of staff, and doctors seem to have quite a lot of difficulty in dealing with it, but that's more to do with their computer literacy rather than the system itself. What sort of new technologies might benefit your job in terms of, the processes you go through with labelling of specimens, and things that you have to do on a day-to-day basis? Would there be, for instance, a sort of RFID technologies perhaps; would they be useful in that respect, to create a little scanner of things that go round? We do have scanners actually. We have all the labels we to use to give a patient number, a lab number, you can always scan all the numbers, you can also scan our names and things, so that makes … [it] useful for when you need to use the computer. So, it makes errors … less errors. Is that through barcode technology? Yes. Ok, thanks very much, thank you.'

Fons, pharmacist, the Netherlands

'My name is Fons, and I have been a pharmacist since 1991 in Hengelo, the Netherlands. I have set up, and am the chairman of the Care Network Twente. This network connects general practitioners and pharmacists in several cities in Twente [Hengelo, Borne, Delden and Goor]. This network provides information concerning patients to all connected stakeholders, and results in benefits such as quick mutual communication, and the transfer of medication assignments between general practitioner and pharmacist, and the other way around. The general practitioner puts an assignment into the system. That assignment, a prescription, is send to the pharmacist, he or she prepares it, and the patient can pick it up easily at the pharmacist. There is also a connection between general practitioners. At all times GPs can see a patient's electronic record. However, I also have a negative aspect on the information sharing. I do not see the benefits of the EHR which the Dutch government tries to implement. According to this system, all providers of care should have communication between one and another. The first system is OZIS [Open Care Information System]. I and lots of other stakeholders also think that this system appears to be certain, but it is not. This system has a translation option, where medication

coming from different countries (e.g. England, France, and Germany) is translated into Dutch. This means that patients can read in Dutch what specific medication they should take during a day. However, since pharmacists use different codes to indicate how many times you should take your pills, it sometimes goes wrong in setting out the right medication. In my opinion, it appears to be safe, but it is not! Therefore, these systems cannot be used yet in the healthcare environment.'

Iris, dentist, the Netherlands

What kind of eHealth system would you like to see on the market?

'My name is Iris, and I am a dentist in Hengelo and Markelo, the Netherlands. I have indeed a good view on eHealth systems. For us as dentists, this could be of major importance, because we do not have information regarding patients coming on a regular basis, patients coming from other dentists, but also patients that come in case of emergency. We do not have data on these patients, and ideally want information regarding patient medication. Patients do not always know what type of medication they use. Especially for dentists it is very important that we know when patients use, for example, blood-diluting medication, or need antibiotics during a treatment. From my perspective, a network between pharmacists, general practitioners and ourselves is critical.'

Do you see more advantages?

'Yes, patients come sometimes to the dentist for emergencies – for example, during the weekend. At that moment, you cannot reach a general practitioner. so you do not know which medication a patient uses. When we have a connection to that system, we can easily check if a patient uses critical medication (e.g. blood diluents, and which type), and proceed to treat the patient as soon as possible.'

Are there also disadvantages?

'Yes, because there are also patients that are in physical healthcare (e.g. using overdoses of medication). Of course, they do not want other people to know this. Perhaps a part of the patient history must be protected.'