

Report on:

Conceptual framework, healthcare and eHealth investment context and challenges

Final

Version 1.0

December 2007



About *Financing eHealth*

The Financing eHealth study was commissioned by DG INFSO and Media, unit ICT for Health, with the aim to assess different financing opportunities against the financing needs of eHealth investment. The overriding goal is to provide assistance to Member States and the European Commission in their efforts to meet the eHealth Action Plan objective of "supporting and boosting investment in eHealth".

Full project title

Assessment of financing opportunities available to Member States to support and boost investment in eHealth

Contract details

Contract number: 30-CE-0121896/0042

Starting date: September 01, 2007

Ending date: August 31, 2008

Number and title of deliverable

This report is deliverable D1.3 of the Financing eHealth study. It addresses the healthcare and eHealth investment context and challenges, and provides the conceptual framework for further work towards boosting investment in eHealth.

Authors

- Tom Jones, TanJent, UK
- Alexander Dobrev, empirica, Germany
- Jörg Artmann, empirica, Germany
- Veli N. Stroetmann, empirica, Germany

Contact

For further information about the *Financing eHealth* study, please contact:



| | |
|--|--|
|  |  |
| <p>empirica Communication and Technology Research Oxfordstr. 2, 53111 Bonn, Germany</p> <p>Fax: (49-228) 98530-12</p> <p>www.empirica.com</p> <p>info at empirica dot com</p> | <p>TanJent Hereford UK</p> <p>Tel: +44 7802 336 229</p> <p>www.tanjent.co.uk</p> <p>tomjones@tanjent.co.uk</p> |

Table of Contents

Executive summary.....5

1 Introduction.....6

2 The wider context of healthcare and eHealth investments.....7

2.1 Health systems in Europe 7

 2.1.1 **Challenges to healthcare systems in EU Member States** 7

 2.1.2 **Resources available to healthcare systems in EU Member States**..... 12

 2.1.3 **The mismatch between challenges and available resources**..... 17

2.2 The role of eHealth in Member State health policies 19

2.3 eHealth strategies..... 19

3 Conceptual framework of eHealth investments.....23

3.1 Defining eHealth..... 23

3.2 The healthcare value system and its actors..... 24

3.3 Supply of finance for eHealth investment..... 28

3.4 Demand for finance for eHealth investment..... 30

 3.4.1 **eHealth investment decisions** 30

 3.4.2 **Factors affecting financing options – a typology of eHealth investments** 34

 3.4.3 **Financial needs of eHealth investments** 36

4 Summary and conclusions39

5 Disclaimer39

6 Annex: draft glossary40

Lists of tables and figures

| | |
|--|-----------|
| Table 1: Clusters of countries by healthcare financing models | 17 |
| Table 2: Conceptual frame for classifying the supply side of eHealth financing | 29 |
| Table 3: Joint development of complex eHealth solutions | 35 |
| Table 4: Supplier developed eHealth solutions..... | 36 |
| | |
| Figure 1: Number of patient-physician contacts over 12 months | 9 |
| Figure 2: Share of overweight and obese population out of total population..... | 11 |
| Figure 3: Number of doctors per 1000 population, 2005 | 13 |
| Figure 4: Number of hospital beds per 1000 population, 2005 | 14 |
| Figure 5: Total healthcare expenditure as share of GDP, 2005..... | 15 |
| Figure 6: Total healthcare expenditure per capita; purchasing power parity USD, 2004..... | 15 |
| Figure 7: The healthcare expense squeeze..... | 18 |
| Figure 8: The healthcare value chain in the healthcare value system..... | 25 |
| Figure 9: Mapping processes to organisations..... | 27 |
| Figure 10: The process of economic and financing decisions | 31 |
| Figure 11: Sub-optimal position - eHealth pushing into healthcare from the outside..... | 32 |
| Figure 12: Constructive strategic fit - eHealth as an integrated factor of production | 33 |
| Figure 13: Typology structure for eHealth investment profiles | 34 |
| Figure 14: Example of economic expenditure curve of an eHealth investment | 36 |
| Figure 15: Timing of sustainable benefit realisation..... | 38 |

Executive summary

Financing opportunities to boost eHealth must be developed and pursued in a proper strategic context that includes:

- Strategic goals, especially the continuing mismatch between healthcare supply and demand and the impact of major health and disease challenges
- A proper context for decisions to invest in healthcare, where eHealth investment decisions are part of the mainstream, not a separate, parallel activity
- Finance that matches the different types of eHealth for their whole life-cycles
- Investment that reflects net benefits, the difference between cumulative costs and benefits over time
- All costs that need to be financed, including risk
- Financing facilities that can include a mix of appropriate types of finance, such as loans, grants, leases, and Public Private Partnerships (PPP)
- Financing facilities that reflect the healthcare models of each Member State.

Challenges of ageing populations, increasing incidence of chronic diseases, and improvements in medical knowledge and technological equipment are main demand drivers across the EU. Each Member State has a different way of responding. eHealth can play an important role by helping to improve the performance and capacity of healthcare systems, but many eHealth investments support healthcare from outside the mainstream strategic context. It is essential that in the near future eHealth investment is integrated into mainstream strategic decisions, then appropriate eHealth financing can be designed that supports net benefit realisation over whole eHealth life-cycles. This report proposes a strategic framework that can be used to achieve this.

It reflects the nature of investment for different types of eHealth, with a fundamental distinction between economic and financial decisions, coupled with identifying the current and desirable position of eHealth in the resource mix. It is unlikely to be a one-size-fit-all solution to boosting eHealth investment. A draft typology of eHealth investments has been compiled to help with this. It will show the different types of eHealth activities and their different investment curves that define different demands for financial resources over the whole investment life-cycles.

The framework will be used for subsequent stages of the study to identify current mismatches between supply of, and demand for, eHealth financing, based on the real needs that should drive investments and define appropriateness of supply. It will help to support a switch from supply-pull demand to needs-driven demand for financing, thus stimulating demand and boosting eHealth investment.

The report should be read with deliverable D2.1 “*Pre-report on financing opportunities available to Member States to support and boost investment in eHealth*” Together, the two reports can be used to create financing opportunities that begin to boost, protect and manage eHealth investments.

1 Introduction

The overriding goal of the Financing eHealth study is to provide assistance to Member States and the European Commission in their efforts to meet the eHealth Action Plan objective of "supporting and boosting investment in eHealth". This report sets the scene of for all further work, by providing an overview of the wider context in which investments have to be made. On the one hand, this context involves the different healthcare systems across Europe. Despite similarities in the challenges they face, health systems have different approaches towards meeting current and future demand for health services. The relation between demand and supply of health services across Europe is dealt with in section 2.1 of this report.

eHealth cannot be implemented in isolation from the health services system, yet its role in supporting the quality and cost effectiveness of, as well as access to, such services is being increasingly recognised on a policy level. This has led to Member States drawing eHealth strategies and setting specific priority areas for near term activities. Plans for Investors in eHealth and healthcare in general, who are not always Member States directly, need to take these action plans and other policy papers into account. Thus, the remainder of chapter 2 presents an overview of European countries' eHealth strategies.

A critical aspect in efforts to boost investment in eHealth is to have a rigorous conceptual framework. This involves some understanding of what eHealth is and how it fits into the health delivery system, addressed in the first half of chapter 3. This study focuses on the financial aspects of eHealth investment, including the potential of financing as a tool to boost investments. Thus, section 3.3 defines the supply side of financing as the sources of funds for eHealth investments. Section 3.4 addresses the most crucial aspect of the conceptual framework; demand for finance for eHealth investment. The conceptual setting includes an analysis and structures of decision-making processes for eHealth investments, the role of eHealth in overall healthcare strategies and investment decisions, factors affecting the financial needs for different types of eHealth and general healthcare investment, and a generic illustration of these requirements.

Chapter 4 gives a short summary of the report, providing a specific view of the conceptual framework, and how it will be employed in the further work of the study team.

2 The wider context of healthcare and eHealth investments

2.1 Health systems in Europe

The health systems of the European Union (EU) are a “fundamental part of Europe’s social infrastructure”. The goals and priorities of Member States in the field of healthcare are *universality, access to good quality care, equity, and solidarity*, all of which constitute a set of overarching values, shared across Europe¹.

Despite their different approaches, all EU health systems aim to ensure that healthcare provision is “patient-centred and responsive to individual needs”². Member States also aim at making their systems financially sustainable, whilst safeguarding common European values.

The overarching setting for healthcare investment can be seen as the interaction of supply of and demand for health services. Increases in demand for health services tend to outstrip increases in supply. As a result, the overall investment challenge is to improve continuously the performance and capacity of the supply side in order to meet some of the growth in demand.

This section presents a general overview of the challenges facing European health systems.

2.1.1 Challenges to healthcare systems in EU Member States

Reviewing the context of healthcare investment has to reflect on the upcoming challenges facing our societies and healthcare systems. Investments, by definition, impact on the future, so they should aim to address issues of rising importance, not just fix short-term drawbacks.

The most important challenge faced by European healthcare systems and society at large is demographic change. Ageing societies lead to changing pathology patterns in the population, often widening the scope and capacity of the health services required. A second large group of challenges to the traditional healthcare model comes under the umbrella of chronic and lifestyle related diseases, such as diabetes or cardio-vascular conditions. Third, there has been a change in the public attitude towards health and healthcare. Although national differences remain substantial, citizens are generally more informed and demand better quality health services³.

Demographic change

According to figures collected by The Economist, 22.7% of the EU-15 population was over the age of 60 in the year 2005. The number for all EU Member States is

¹ European Council (2006): Council Conclusions on Common values and principles in European Union Health Systems. Document (2006/C 146/01), published in the Official Journal of the European Union on 22 June 2006, p. 3

² *ibid.*

³ Observation made on the basis of results from the eUser survey 2005; see www.euser-eu.org

approximately 22%⁴. As fertility rates in Europe decline and people live longer lives, the population is shrinking and the share of older people increases. The share of the population 65+ is projected to reach 19.6% of the total population in the EU-15 by the year 2020. In the year 2000, the share was at 16.4% of the total population⁵.

The first important consequence of the rise in the number of the elderly is a change in the composition of diseases a healthcare system has to tackle. Data from the SeniorWatch study⁶, and from the subsequent EU Study on Health, Ageing and Retirement in Europe (SHARE)⁷, reveal the link between ageing and the prevalence of chronic diseases⁸. In the SeniorWatch study, 69% of individuals from the age cohort of 70 to 79 year olds reported to suffer at least from one of five common chronic diseases⁹. The SHARE study found that almost 50% of the survey participants suffered from some kind of long-term health problem. Chronic conditions most frequently cited were arthritis, diabetes, and heart disease. Risk factors, such as hypertension and high cholesterol levels, were also reported frequently.

It is well known that healthcare consumption increases disproportionately with age. In general, per capita spending in the age group of the 85 to 89 year olds is on average five times higher than for the 35 to 39 year olds¹⁰.

The frequency of medical consultations in one year is strongly related to a patient's age. Figure 1 illustrates findings¹¹, according to which 52% of those aged 80 to 84 visit a doctor seven or more times per year. Only 19% of people aged 50 to 54 do.

⁴ Figures based on The Economist (2007), Pocket world in figures 2008 Edition, ISBN: 978 1 86197 844 8

⁵ OECD Health Data 2006

⁶ SeniorWatch: European Senior Watch Observatory and Inventory – IST – 1999-29086, in particular: Deliverable 2.3

⁷ <http://www.share-project.org/>

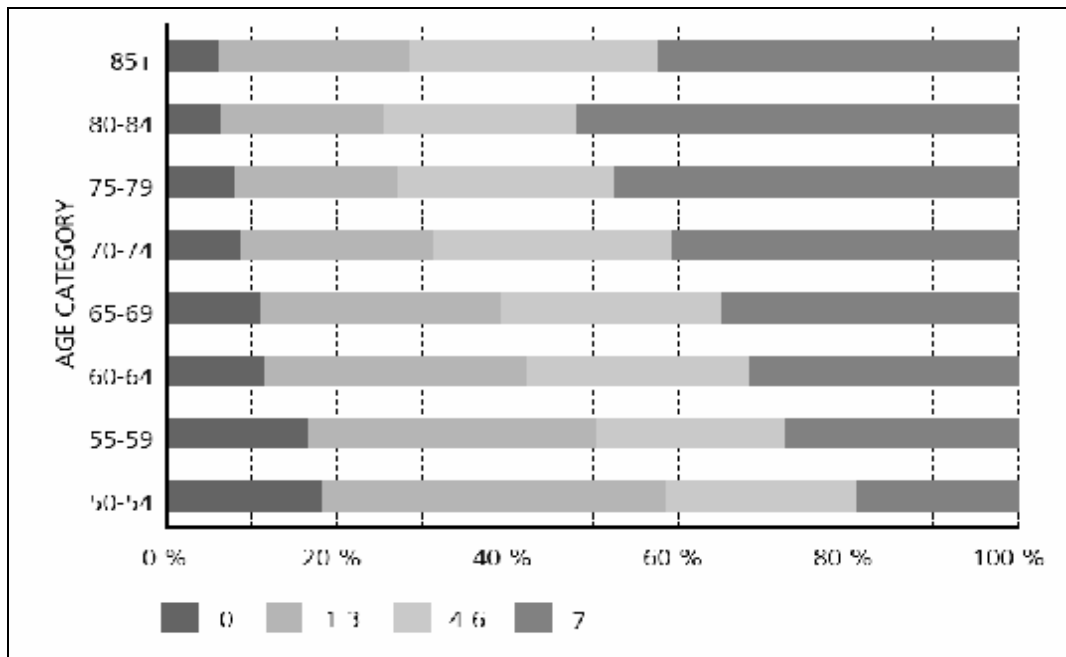
⁸ See Börsch-Supan A, Brugiavini A, Jürges H, Mackenbach J, Siegrist J, Weber G (eds.) (2005) Health Ageing and Retirement in Europe: First Results from the Survey of Health, Ageing and Retirement in Europe, Mannheim: Research Institute for the Economics of Ageing.

⁹ These diseases were: high blood pressure, joint/bone/muscle disease, heart disease, diabetes and chronic respiratory disease.

¹⁰ Hofmarcher MM and Riedel M (2002) Age structure and health expenditure in the EU: Costs increase, but do not explode, Health Systems Watch III, Autumn, Vienna Institute for Advanced Studies.

¹¹ Santos-Eggimann B, Junod J, Cornaz S (2005) Health Services Utilisation in Older Europeans, in: Brugiavini A, Börsch-Supan A, Jürges H, Mackenbach J, Siegrist J, Weber G (2005) Health Ageing and Retirement in Europe: First Results of the Survey on Health Ageing and Retirement in Europe, Mannheim Research Institute for the Economics of Ageing (MEA).

Figure 1: Number of patient-physician contacts over 12 months



Source: Santos-Eggimann et al. 2005

Chronic and lifestyle related diseases

Across the EU, health systems need to deal with a wide range of diseases. Among these, four have been identified as posing particularly pressing challenges. Healthcare investment for, and in, the near future, including eHealth investments, will have to address with these conditions.

Neuropsychiatric disorders - depression

Depression is the major cause for disability throughout the WHO’s European Region. The indirect costs of the disorder have been estimated at seven times the direct costs. Between 5% and 10% of the European population are affected by depression at any point in time. However, under-diagnosis is common, with 50% of citizens using primary care not properly diagnosed with depression¹². Depression is forecast to be the second most burdensome health condition world wide by 2020, including associated disability and premature mortality¹³. Analysed by income group levels, uni-polar depressive disorders are forecast to be the number one cause for disability adjustment in life years (DALY) in high income countries by 2030¹⁴.

Cardiovascular disease

Cardiovascular disease (CVD) comprises a set of diseases related to problems of the heart and blood vessels. Coronary heart disease (CHD) and stroke are the most common cardiovascular diseases. Together, they account for 42% of all cases of death in the EU.

¹² WHO (2005) European Health Report 2005, Copenhagen: WHO Regional Office for Europe.

¹³ Murray CJL and Lopez AD (1997) Alternative projections of mortality and disability by cause 1990 – 2020: Global Burden of Disease Study, Lancet 349:1498-1504.

¹⁴ Mathers CD and Loncar D (2006) Projections of Global Mortality and Burden of Disease from 2002 to 2030, PLoS Medicine 3(11) e442: 2011-30.

Stroke alone is the second single most common cause of death, accounting for 1.28 million deaths each year. Although overall CVD mortality and incidence are falling in Northern, Southern and Western European countries, Eastern European countries are either facing a rise, or a slower fall, in incidence and mortality rates than the rest of Europe¹⁵.

The incidence of stroke in Europe is projected to increase from 1.1 million cases annually in 2000 to 1.5 million cases in 2025, solely due to demographic changes¹⁶. Ischemic heart disease, a subgroup of cardiovascular disease, is projected to rank second in terms of the burden of disease for high income countries in 2030¹⁷.

Cancer

Approximately 18% of all deaths in the WHO's European Region in 2003 were due to cancer. Mortality rates for cancer in general have declined since the 1990s¹⁸. A study of cancer mortality¹⁹ suggests that an 11% reduction of total cancer mortality from 2000 to 2015 is "realistic and possible." Much of this decrease is achieved by a decreased prevalence of smoking, a trend which has only recently been confirmed by the WHO European Office²⁰, and the associated decline in lung cancer deaths in men. The impact of smoking should still not be underestimated: in some countries, such as the Netherlands, Bulgaria, and Poland, over 30% of the population smoke every day²¹. An improvement in diagnosis and treatment of breast cancer over the last years is a possible cause for the decline in cancer mortality among women²². Nevertheless, nearly 3.2 million cancer cases were diagnosed in Europe in 2006, leading to 1.7 million cancer related deaths. As the European population is ageing, the incidence of cancer will increase, even if age-specific rates remain constant²³.

¹⁵ Petersen S, Peto V, Rayner M, Leal J, Luengo-Fernandez R, Gray A (2005) European cardiovascular disease statistics: 2005 edition, BHF: London, online: <http://www.heartstats.org/uploads/documents%5CPDF.pdf>, [accessed: December 2007]

¹⁶ Truelsen T, Piechowski-Jóźwiak B, Bonita R, Mathers C, Bogousslavsky J, Boysen G (2006) Stroke incidence and prevalence in Europe: a review of available data, *European Journal of Neurology* 13(6): 581-598.

¹⁷ Mathers CD and Loncar D (2006) Projections of Global Mortality and Burden of Disease from 2002 to 2030, *PLoS Medicine* 3(11) e442: 2011-30.

¹⁸ WHO (2005) *European Health Report 2005*, Copenhagen: WHO Regional Office for Europe.

¹⁹ Levi F, Lucchini F, Negri E, La Vecchia C (2007) Continuing declines in cancer mortality in the European Union, *Annals of Oncology* 18(3): 593-595.

²⁰ WHO (2007) *The European Tobacco Control Report 2007*, WHO Regional Office for Europe, Copenhagen.

²¹ WHO, European health for all database (HFA-DB), <http://www.euro.who.int/hfadb>, last update November 2007

²² Levi F, Lucchini F, Negri E, La Vecchia C (2007) Continuing declines in cancer mortality in the European Union, *Annals of Oncology* 18(3): 593-595.

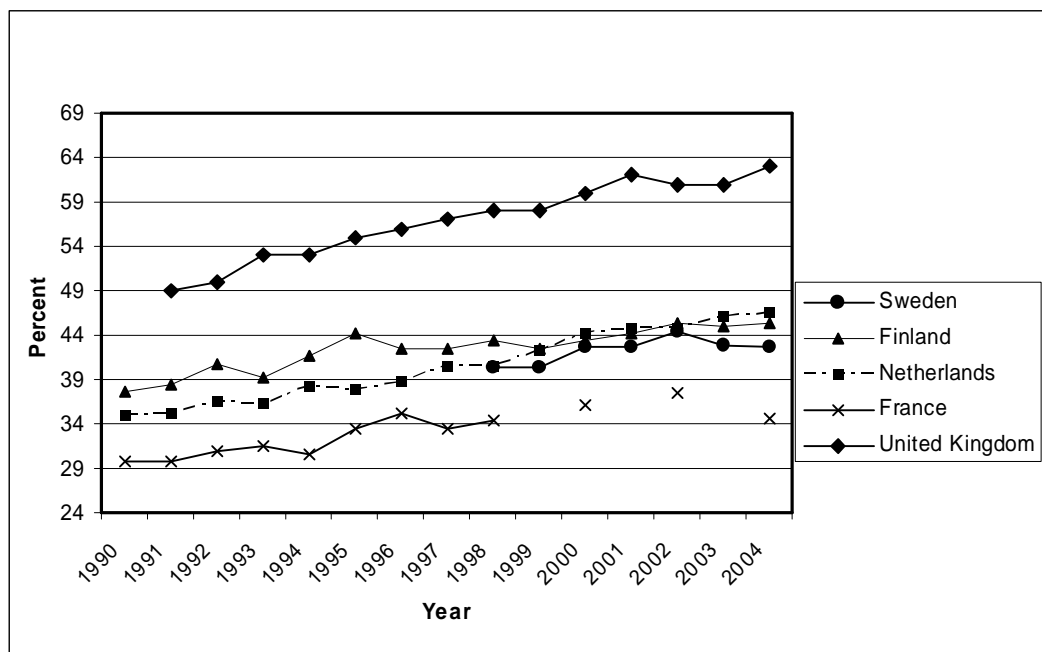
²³ Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P (2007), Estimates of the cancer incidence and mortality in Europe in 2006, *Annals of Oncology*, 18(3): 581-592.

Leading risk factors: overweight and obesity

Overweight and obesity²⁴ are serious challenges to healthcare systems in the developed world. Together with smoking, alcohol consumption, an unhealthy diet, and lack of physical activity, obesity is the leading, preventable risk factor for a number of Non-Communicable Diseases (NCDs).

The WHO's European Office reports that, for 2005, in many countries in its region over half the adult population was classified as overweight, and between 20–30% of adults are categorised as clinically obese²⁵. Looking back, the prevalence of obesity in the WHO European Region has tripled over the last two decades. More worryingly, if the prevalence rate of the mid 1990s continues to determine obesity rise in the future, approximately 150 million children and adolescents will be obese by 2010²⁶. The rise in the overweight population in a selected number of European countries in the last two decades is illustrated in Figure 2 below.

Figure 2: Share of overweight and obese population out of total population



Source: OECD Health Data 2006

Obesity is known to be a risk factor for a number of physiological illnesses. These include, among others, coronary heart disease, stroke, congestive heart failure, certain types of cancer and psychological disorders²⁷. It can be argued that obesity is at the core of the non-communicable diseases which represent the biggest burden of disease in Europe.

²⁴ Overweight is defined as a Body Mass Index (BMI) between 25 and 30; Obesity as a BMI of 30 to 40. The BMI measures weight relative to height.
²⁵ WHO (2005) European Health Report 2005, Copenhagen: WHO Regional Office for Europe.
²⁶ WHO (2006) The challenge of obesity in the WHO European Region and the strategies for response, WHO European Ministerial Conference on Counteracting Obesity, EUR/06/5062700/6, 28th August Copenhagen: WHO Regional Office for Europe.
²⁷ Lang T (2005) Obesity: a growing issue for European policy?, Journal of European Social Policy 15(4): 301-327.

The rising prevalence of obesity in younger people is the most alarming aspect of obesity. Overweight among children in Switzerland increased from 4% in 1960 to 18% in 2003²⁸. In the United Kingdom, obesity among children was at 10.9% in 1995 and 18.0% in 2005 for boys. The respective rates for girls were 12.0% and 18.1%²⁹.

Public attitude and expectations

One of the most profound challenges to the traditional healthcare model comes in the form of changing attitudes towards health and healthcare. The demand for better and new services is an inevitable consequence of the advances in medical science and technology and the expectations for future opportunities. The increase in range and quality of services, including utilisation of high-tech equipment and pharmaceuticals, puts continuous pressure for health services spending levels to increase.

Health is a multi-faceted phenomenon and the internet has become a common means to seek information about health: According to the eUSER survey in 2005³⁰, over 50% of internet users across the EU, over 30% of the total European population³¹, have searched for health information online. More than 90% of them are repeat users³². A result of this new awareness is the demand for patient centred care. There is a demand for the role of the patient to change from being a passive recipient of care towards becoming a proactive and more responsible participant in the healthcare processes. Healthcare systems are responding by giving patients a number of explicit rights.

2.1.2 Resources available to healthcare systems in EU Member States

Europe is in a privileged position with regards to healthcare: the 27 EU Member States have been able to spend over € 1 trillion on healthcare in 2005. The return on such high expenditure is no less impressive: out of the 27 EU Member states, 18 are in the top 45 worldwide in terms of life expectancy³³. No Member state is in the bottom 50 countries world wide. Infant mortality in 14 out of the 25 countries world-wide with lowest rates, are Member States. None are among the 40 countries with highest infant mortality rates.³⁴

Demand for healthcare is more complex than these high-level statistics, so there is constant pressure for improvements. The investment decisions that are needed can be seen within an overview of the resources currently available.

²⁸ WHO (2006) Ninth Futures Forum on health systems governance and public participation, Amsterdam, NL, 10-11 October 2005.

²⁹ NHS (2006) Health Trends Survey 2005, Press Release, online: <http://www.ic.nhs.uk/news/press/pr201206c>, [accessed December 2007].

³⁰ eUSER (2005) Evidence-based support for the design and delivery of user-centred online public services; www.euser-eu.org

³¹ eUser Population Survey (2005) Searching for Health Information on the Internet 2005, online: <http://www.euser-eu.org/ShowCase.asp?CaseTitleID=858> [accessed April 2007]

³² eUser Population Survey (2005) Frequency of searching online for health information, online: <http://www.euser-eu.org/ShowCase.asp?CaseTitleID=861> [accessed April 2007]

³³ Spain is the first Member State on the 7th place with 80.9 years; Top of the list is Andorra, with 83.5 years.

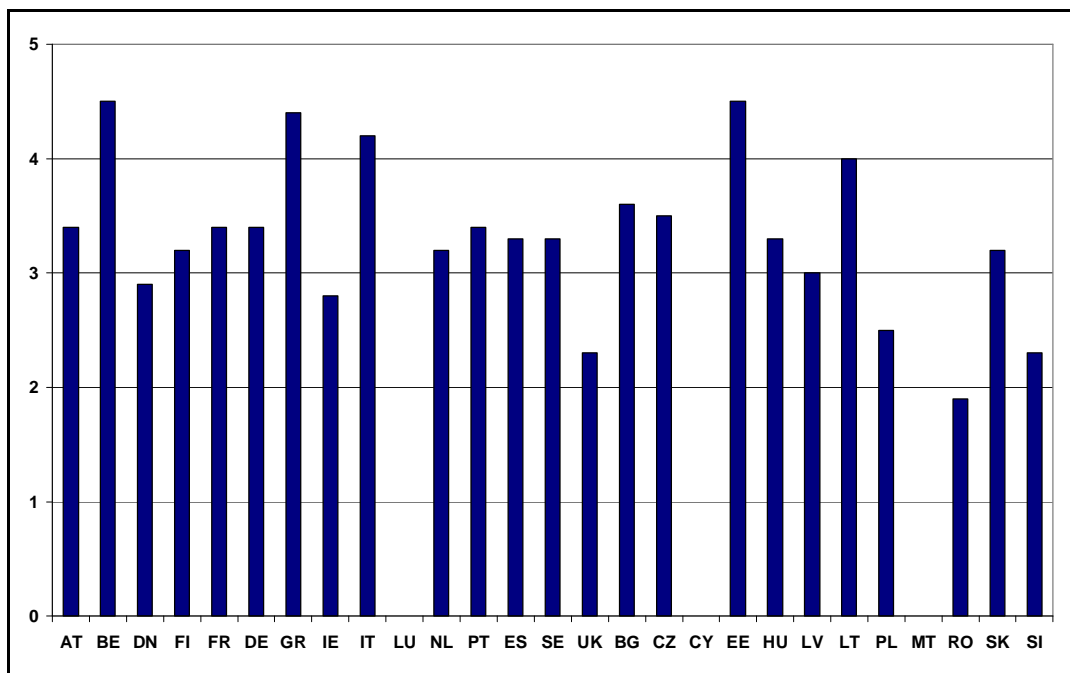
³⁴ Figures based on The Economist (2007), Pocket world in figures 2008 Edition, ISBN: 978 1 86197 844 8

Statistics on healthcare resources

A well-known feature of European healthcare systems is its diversity. Common values, and a general tendency towards perceiving the ‘European model’ as more “social” compared to other countries, especially the USA, are expressed in significant variations in the organisation of health systems across Member States

An example is the number of doctors per 1000 people in the population varies between less than 2 in Romania and 4.5 in Belgium and Estonia. Detailed numbers are shown in Figure 3 below. Numbers of specialist and nurses also vary significantly: the Netherlands reports only 0.4, compared to Greece with more than four times as many specialist per 1000 people³⁵; Nurses per 1000 population vary between less than 4 in Greece and more than 15 in Ireland³⁶.

Figure 3: Number of doctors per 1000 population, 2005



Source: The Economist, 2007³⁷

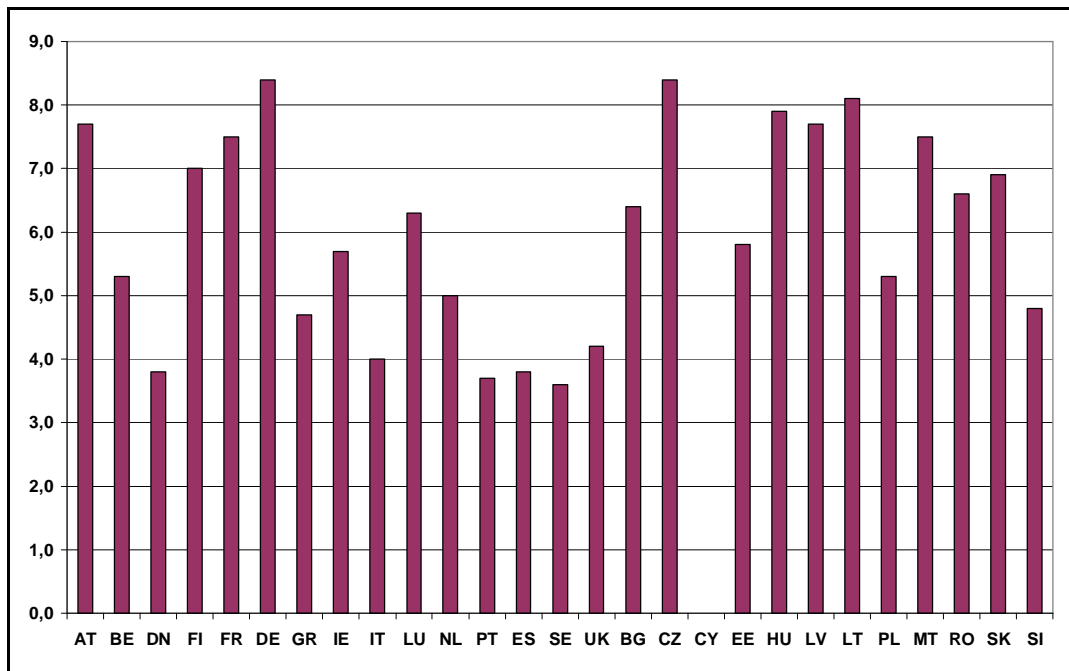
Diversity in European health systems is also evident in the hospital sector, as shown in Figure 4. In Denmark, Portugal, Spain, and Sweden, every 1000 people have fewer than 4 hospital beds, whereas in Germany and the Czech Republic, they have more than twice as many.

³⁵ Data for 2004, WHO, European health for all database (HFA-DB), <http://www.euro.who.int/hfad/b>, last update November 2007

³⁶ Data for 2005, based on The Economist (2007), Pocket world in figures 2008 Edition, ISBN: 978 1 86197 844 8

³⁷ Figures based on The Economist (2007), Pocket world in figures 2008 Edition, ISBN: 978 1 86197 844 8

Figure 4: Number of hospital beds per 1000 population, 2005



Source: The Economist, 2007³⁸

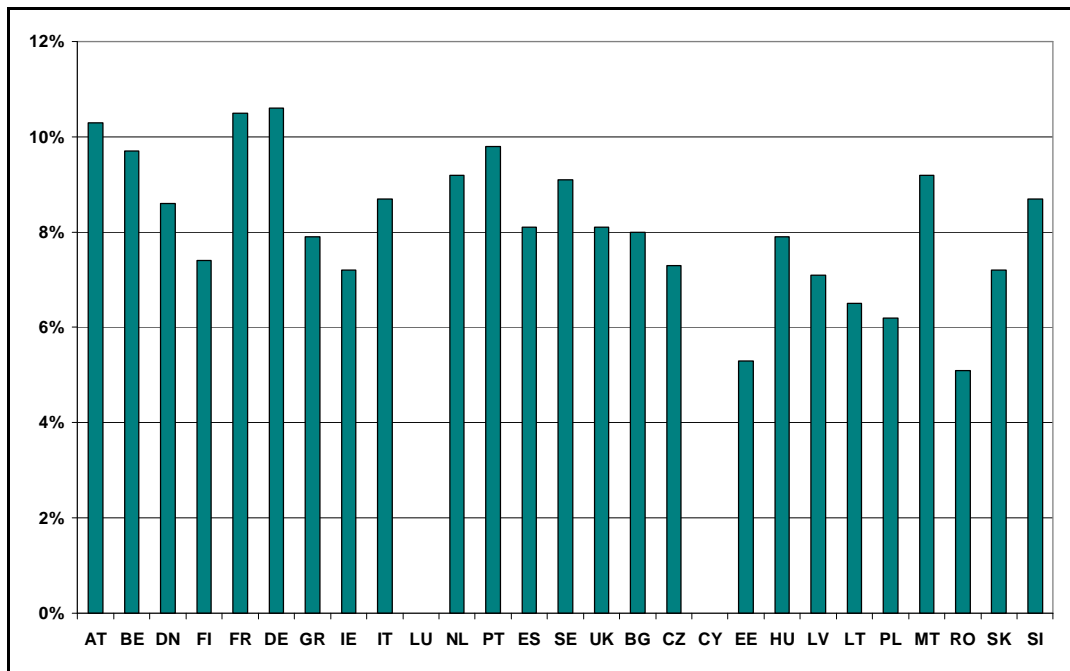
Differences do not follow an old-versus-new Member States pattern. The data in the figures above shows that variations among the EU15 and EU12 are as common and significant as variations between countries of the two groups. These variations are significant for the wider context of healthcare and eHealth investment as they point to differences in the relative size, role, influence, and power of different stakeholder groups. Furthermore, system structures affect decisions on what to invest in, who should invest, and why and where to invest.

At a general level, Member States invest a wide range of the financial resources in healthcare. This is important in the context of investment decisions and attempts to boost investment in eHealth. For example, countries with relatively high expenditure levels are more likely to have to re-allocate budgets in order to invest in new projects, whereas the scope for increase in the amount of funds available will be greater among countries that have currently lower levels of spending.

As shown in Figure 5 below, Member States spend between 5% and 10.5% of their GDP on healthcare. The last two countries to join, Bulgaria and Romania, devote the lowest shares of their income to health.

³⁸ Figures based on The Economist (2007), Pocket world in figures 2008 Edition, ISBN: 978 1 86197 844 8

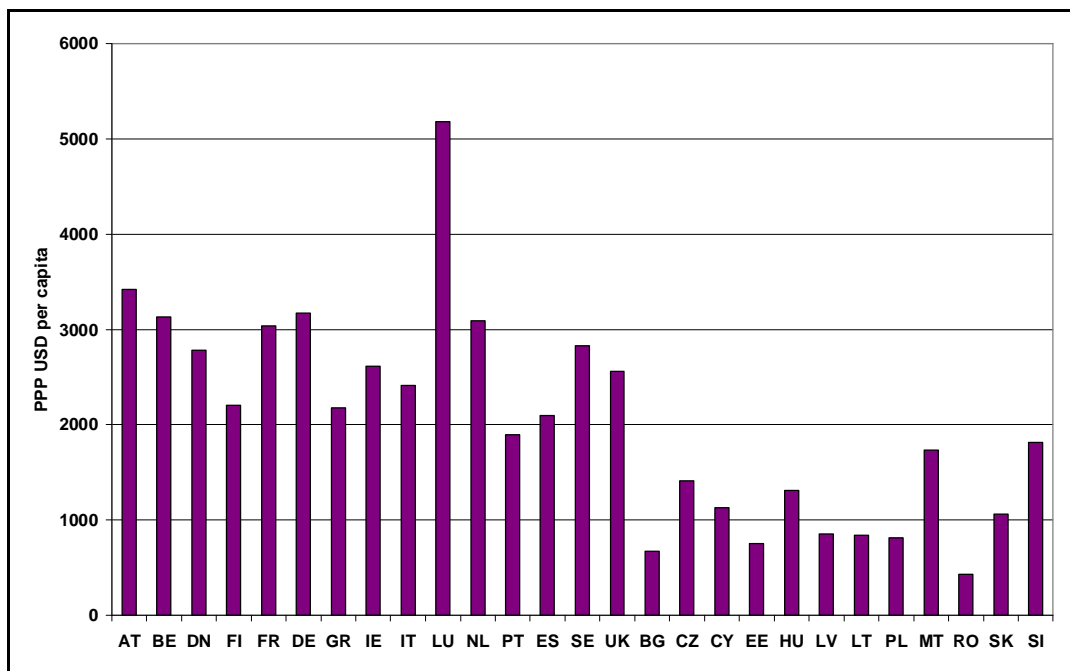
Figure 5: Total healthcare expenditure as share of GDP, 2005



Source: The Economist, 2007³⁹

Actual cash available for healthcare, measured in spending per capita and shown in Figure 6 below, shows a clear distinction between “old” and “new” Member States can be drawn. In 2004, only a few of EU12 spent more than 1000 USD per person on healthcare, whereas most of EU15 spent more than twice as much.

Figure 6: Total healthcare expenditure per capita; purchasing power parity USD, 2004



Source: WHO HFA-DB, 2007⁴⁰

³⁹ Figures based on The Economist (2007), Pocket world in figures 2008 Edition, ISBN: 978 1 86197 844 8

A simple correlation of the statistics presented above confirms the differences between resource allocations in Member States⁴¹.

Because of the positive income elasticity of healthcare spending, the observed differences in expenditure can partly be explained by differences in wealth. As people become wealthier, the proportion of their income they are willing to spend on healthcare increases. "Income growth is certainly the main non-demographic driver of expenditures, although the vast literature on this topic is still somewhat inconclusive on the precise value of the income elasticity"⁴². Thus, rising expenditures on health, whether direct or through taxation, are in part a natural effect of increasing wealth.

Projecting future healthcare spending is an extremely difficult exercise. Yet a rise is inevitable and widely expected to take place. The scope of this increase is, however, limited, which puts pressure on health policy makers, as well as healthcare providers and other stakeholders, to invest in improving the efficiency and effectiveness of health services in order to meet increasing demand.

Investment in healthcare also varies considerably between Member States. In 2004, Spain and Finland allocated 3% of their total expenditure on healthcare to investment, whereas Ireland and Norway invested 7% and 6.6% respectively⁴³. Unfortunately, there is only limited published data about some of the financing models for healthcare investment, especially on eHealth. Most of the data on healthcare financing deals with routine, operational expenditure for treatment and care, not with longer-run changes needed to sustain and improve performance. This includes limited data on capital expenditure, because not all health systems record capital expenditure on healthcare provider balance sheets. For example, in Germany, until recently, many public hospitals were able to finance investments from the investment budgets of the responsible communities or states. Neither did they apply commercial accounting practices reflecting capital investments, nor depreciation or cost calculation schemes.

Financing models

Besides the size of financial and non-financial resources employed in healthcare, the way resources are utilised is the other critical factor affecting the potential for boosting investment in eHealth in general and the types of investments to be expected.

Member States have different models of organising and financing the supply of health services. A main distinction is between the Beveridge and the Bismarck models. The Beveridge model, which was the foundation of the NHS in the UK, bases health services financing on taxation. The Bismarck model, originally developed in Germany, involves insurance contributions separated from taxation. Private insurance schemes also have a

⁴⁰ Data from the WHO European Health for All Database, <http://data.euro.who.int/hfad/>

⁴¹ For example, the correlation coefficient between Doctors per 1000 population and HC expenditure per capita in PPP USD for all Member States is insignificant 0.129; Correlating hospital beds per 1000 population to healthcare expenditure per capita in PPP USD yields a coefficient of -0.188

⁴² OECD (2006) Projecting OECD Health and Long-Term Care Expenditures: What are the main Drivers?, Economics Department Working Papers No. 477, ECO/WKP(2006)5.

⁴³ Source: "OECD Health Data 2006: A comparative analysis of 30 countries", OECD, June 2006, www.oecd.org/health/healthdata

place in addition, and in parallel, to both models. A hypothesis is that Beveridge models can make it easier to change levels of eHealth investment, as observed in Scandinavian countries and the UK.

Some of the different models of financing healthcare have been classified into clusters for the EU15 by Jakubowski et al.⁴⁴, as shown in table 1. The study team is currently in the process of researching potential changes to the status presented in the table, as well as classifying the additional EU12 appropriately. The results of this work will feed into later reports.

Table 1: Clusters of countries by healthcare financing models

| Country | Predominant system of finance | Main supplementary system of finance |
|--|--|---|
| Finland, Greece, Ireland, Italy, Sweden, Spain, UK | Public: Taxation | Private voluntary insurance, direct payments |
| Denmark, Portugal | Public: Taxation | Direct payments |
| Austria, Belgium, France, Germany, Luxembourg | Public: Compulsory social insurance | Private voluntary insurance, direct payments, public taxation |
| Netherlands | Mixed compulsory insurance and private voluntary insurance | Public taxation, direct payments |

Source: Jakubowski et al., 1998

Informal observations can already be presented. Countries that were east of the Iron Curtain shared a similar legacy system during the first half of the 1990s. It was an extreme version of a Beveridge model, with nearly all health-related costs covered by the state. In the last 15 years, the systems have undergone various reforms, often moving towards Bismarck-like arrangements and opening up the health services sector to private actors.

Public and private are the main two categories of sources of financing healthcare. An average of some 72% of total healthcare expenditure across OECD countries in 2001 relied on the public sector as the main source of finance⁴⁵. In Europe, the shares have been fairly stable in the first half of the decade, ranging from about 53% in Greece to some 90% in the Czech Republic and Luxembourg⁴⁶.

2.1.3 The mismatch between challenges and available resources

The overarching setting for healthcare investment can be seen as the interaction of supply of healthcare, addressed in section 2.1.2 above, and demand for health services, discussed in section 2.1.1. The increase in demand for health services tends to outstrip the increase in supply. This development has been described as “the ‘squeeze’ that is

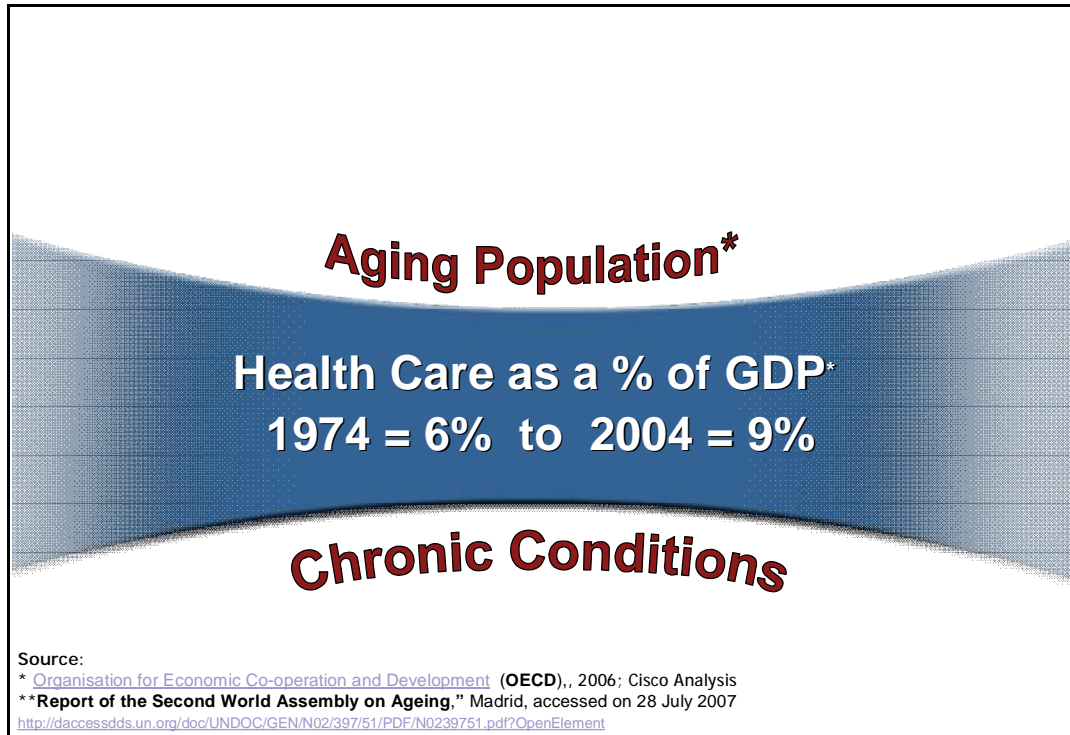
⁴⁴ Jakubowski, E., Busse, R. and Chambers, G.: Health Care Systems in the EU - A comparative study. European Parliament Working paper SACO 101 EN, 11-1998.

⁴⁵ Source: OECD Health Data 2004, quoted in “Anatomy lesson – How health-care services are financed”, The Economist print edition, Jul 15th 2004, http://www.economist.com/displaystory.cfm?story_id=E1_NRJVJRQ

⁴⁶ Source: “OECD Health Data 2006: A comparative analysis of 30 countries”, OECD, June 2006, www.oecd.org/health/healthdata

taking place between health systems with limited resources as a result of ageing populations faced by the spread of chronic diseases⁴⁷.

Figure 7: The healthcare expense squeeze



Source: Cisco Systems⁴⁸

As confirmed in the cited presentation, the upcoming, new scales in demand require a new way of thinking as we do not have the number of people to cope with them. The shortage of some health personnel is already acute in countries like the UK and those in Scandinavia. This is evident from the fact that the United Kingdom has adopted a strategy of attracting medical workers from abroad. 73% of the increase in the United Kingdom's NHS nurses between 1997 and 2003 was accomplished through international recruitment⁴⁹.

The problem of an increasing number of patients suffering from chronic diseases, combined with an expected future shortage in healthcare personnel, also points to the new kinds of medical services that will be demanded in the future: more care will have to be delivered at home, potentially supported by telemonitoring devices. A decrease in face-to-face contact in healthcare provision, and a reallocation of the available financial and non-financial resources seem inevitable.

As a result of the worsening mismatch between supply of and demand for health services, the generic investment challenge is to improve the performance and capacity of the supply side in order to meet some of the growth in demand. The eHealth IMPACT

⁴⁷ Petra Wilson, Cisco Systems, "Transforming Access & Managing Our Health", Presentation at the World of Health IT 2007 conference, Vienna, 23 October 2007

⁴⁸ Petra Wilson, Cisco Systems, "Transforming Access & Managing Our Health", Presentation at the World of Health IT 2007 conference, Vienna, 23 October 2007

⁴⁹ Pond B and McPake B (2006) The health migration crisis: the role of four Organisation for Economic Cooperation and Development countries, *The Lancet* 367: 1448-55.

study⁵⁰ showed that effective eHealth solutions can substantially contribute to improvements in quality, access and efficiency of healthcare. In this sense, boosting investment in eHealth is an essential part of the future of European healthcare systems.

2.2 The role of eHealth in Member State health policies

According to official documents collected during the *eHealth ERA* project⁵¹, “eHealth is either increasingly becoming an integral element of national health system objectives, or it is seen as a key enabler in wider contexts like improving the quality and efficiency of public services or speeding up the development into knowledge driven societies.

While national strategies for eHealth vary from country to country, the general objective is to provide increased quality of care as efficiently and effectively as possible. The development of ICT-enabled applications is viewed as very important. Many governments consider that ICT usage is an essential condition for improved affordability and quality of healthcare to citizens. Germany’s strategy, for example, establishes an ICT infrastructure which can be built on by a wide variety of solutions without incurring unnecessary further costs.

The role of the patient is clearly evident in the ICT strategies of certain countries such as Ireland, Portugal and England. Ireland, for instance, plans to build an ICT framework placing ICT in the context of healthcare reform and citizen-centred services, while England is focused on implementing an integrated ICT infrastructure which will enable patients to make informed health choices and which will lead to greater efficiency. Likewise, Portugal plans to use ICT to place the citizen at the centre of the health system, while increasing the quality of services provided, increasing the efficiency of the system and reducing costs⁵².

The state of play should be seen from two different perspectives. On the bright side, the fact that eHealth is entering healthcare policy is encouraging and will act as a facilitator for future eHealth investments. A downside is that overcoming the gap between policy objectives and actual implementation is always a difficult challenge. In order to support Member States and the European Commission (EC) in bridging that gap, the study team has adopted a critical approach to assessing current activities.

2.3 eHealth strategies

For quite some time, the EU, through the various framework programmes for research and technology development (RTD) has strongly supported the development of ICT applications in the health sector, albeit with mixed results⁵³. The same holds for various

⁵⁰ eHealth IMPACT: Study on the economic and productivity impact of eHealth (2006), commissioned by DG IN-FSO <http://www.ehealth-impact.org>

⁵¹ eHealth ERA: Towards the Establishment of a European e-Health Research Area; FP6-2005-IST-015854; www.ehealth-era.org

⁵² European Commission 2007, “eHealth priorities and strategies in European countries”, Luxembourg: Office for Official Publications of the European Communities, ISBN 92-79-02957-6

⁵³ Cf. Stroetmann KA, Stroetmann VN (2004): IST IMPACT Study - Analysing and assessing the socio-economic impact of Information Society Technology research and development projects supported by the EU framework programmes (FP4 and FP5) in three domains: eHealth applications.

national activities: only recently have these gained in scope and relevance for healthcare professionals and citizens⁵⁴.

Recognition that past and current activities do not realise their full potential is evident by indications in the eHealth action plan. Even now, three years on, eHealth “development is [often] still at a pilot phase, often financed through research grants”. “Commitment and leadership of health authorities, in particular related to financial and organisational issues, are essential elements for the successful deployment of eHealth”⁵⁵.

Arguing that no progress has been made would be neither fair, nor plausible. Virtually all Member States now have eHealth strategies in dedicated documents, or as part of wider eServices policies. EU-level activities have often played an initiating or supportive role for this development. Increasingly, eHealth is becoming a mainstream priority of national health systems. This section provides some insights on the current activities and future plans of Member States with regard to eHealth. The overview is based on the work of the eHealth ERA project published in 2007⁵⁶.

Member States strategies and EU initiatives

The role of European institutions and activities, in particular the EC’s eHealth Action Plan, in raising awareness in the field of eHealth, is evident in the content of national strategy papers. More than half of the eHealth policy fact sheets collected by the eHealth ERA project make an explicit reference to at least one initiative or policy document at the EU level, and seven refer directly to the eHealth Action Plan as the basis of the developed national strategy. The i2010 Initiative, the *eEurope* Action Plan, the initiative to introduce a European Health Insurance Card (EHIC) and the aim to facilitate mobility of citizens, patients and professionals⁵⁷, as well as the EU’s legal framework, are other initiatives mentioned.

In several other instances, there are implicit indications of pursuing eHealth actions in line with EU initiatives. For example, the main driver of an eHealth strategy could be a national Electronic Health Record (EHR) system based on a common organisational and technology infrastructure. These are also core themes in the eHealth Action Plan.

Operational objectives

Policies, administrative, and monitoring structures are not sufficient for the effective deployment and further development of beneficial eHealth solutions. Focused goals and

⁵⁴ For details, see Stroetmann KA, Stroetmann VN: Electronic business in the health and social services sector - Key issues, case studies, conclusions. Sector Impact Study No. 10-II. The European e-Business Market W@tch, Brussels/Bonn, August 2004; available at <http://www.ebusiness-watch.org>

⁵⁵ Commission of the European Communities - COM (2004) 356: 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 health care better for European citizens: An action plan for a European e-Health Area, Brussels, 2004-04-30, page 12.

⁵⁶ European Commission 2007, “eHealth priorities and strategies in European countries”, Luxembourg: Office for Official Publications of the European Communities, ISBN 92-79-02957-6

⁵⁷ Cf. Follow-up to the high level reflection process on patient mobility and health care developments in the European Union, op. cit.

D1.3: Conceptual framework and context

objectives for immediate and medium term actions are the next step towards actual introduction of ICT in health services. More than half of the eHealth policy fact sheets make reference to a clearly defined set of short- and medium-term priorities, ranging from disseminating stand-alone applications and systems, building national eHealth infrastructures that connect existing applications and systems, and creating comprehensive, national, EHR systems. Specific objectives include introducing methods of identifying patients, such as *eCards*, and web portals for citizens and health professionals. Interoperability standards, including semantic issues as well as the legal and regulatory framework required for complex, large-scale endeavours are also high on the priority lists. Each country concentrates on a subset of these kinds of aspirations. Indeed, across the board there is a high degree of consistency with the priorities stated in the EU eHealth Action Plan.

However, public health issues or the need for focused eHealth training and education are rarely mentioned, but for France. Another notable omission in the countrywide fact sheets is attention to reimbursement and other socio-economic aspects, such as the effectiveness of resource allocation, sustainability of initiatives, economic efficiency, and change management; all issues that fall squarely under the Member States' own authority.

Developing eHealth not only brings about new opportunities, but also new risks. In order to ensure that risks are managed appropriately, including the protection of citizens from the misuse of data, the legal framework provided by the European Data Protection Directives is essential. Several EU Member States have started to implement, or plan to implement, legislation in a number of areas, including patients' rights in Belgium; privacy rights in Belgium and Ireland; certification of patient records related software in Belgium; public information in Estonia; and using digital signatures in the Czech Republic, Estonia, Latvia, Lithuania, Poland and England.

Implementation activities

There are not yet many large-scale national eHealth activities that are in routine operation. However, the scale of activity is extensive. Most projects are at stages of development, pilots or larger tests. Five operational national health web portals for citizens are available, two countries have fully implemented ePrescribing systems, though with varying functionalities, and three use electronic messages for sending referrals and discharge letters between health service providers. Three Scandinavian countries, Denmark, Sweden and Norway, have already implemented fully operational national ICT infrastructures specifically to support communications in the health sector.

The majority of regional or nationwide activities highlighted in the national eHealth fact sheets are being developed. The first pilots are either already underway or scheduled for the next 12 to 24 months. Half of the countries are working on a national eHealth infrastructure that will connect all actors of the health sector, such as primary care, secondary care, pharmacies, and homecare. The challenge of reaching this goal requires a series of other issues to be addressed, which are identified as essential in both the eHealth Action Plan and the wider literature; these include technical and semantic interoperability, security, and personal identifiers.

D1.3: Conceptual framework and context

Several key projects involve national health information systems focusing on basic national Electronic Health Record systems, for example Austria, the Czech Republic, Denmark, Estonia, Finland, Romania, Slovakia and Spain. Projects are in place for Electronic Patient Records (EPR) or EPR summaries. Examples include Denmark, Finland, Greece, and Italy. Four countries, Denmark, England, Estonia, and Greece, are working simultaneously on EHR and national eHealth networks. Healthcare data networks in Denmark, Luxembourg, and Portugal, and national health portals in Denmark, Finland, France, Hungary, Luxembourg, and Slovakia, which aim at informing citizens and health professionals, have either been launched or are currently under development.

Other activities include various forms of eCards, currently only used for administrative and insurance status validation. eCards are being developed in Austria, France, Germany, Slovenia, and regions in Italy and Spain, among others. In England, Finland, Greece, Portugal, Spain, Sweden, and Northern Ireland, ePrescribing is being introduced. Platforms for electronic messages and public health data monitoring and warehousing applications are also listed as priority activities in a handful of markets. In Ireland, for example, the national general practitioner messaging project has developed an electronic communication system between primary and secondary care.

Given the complexity and breadth of full-scale implementation, many countries are focusing on specific topics in the near future, with specific timelines. In England, for instance, implementation of the New National Network (N3) began in April 2004. The Personal Demographic Service and a simple Messaging Service went live in July 2004, the ePrescription implementation, although with a long timescale to completion, started in December 2004, and the wider introduction of PACS, the digital picture archiving and communication systems, followed from 2005, and should be live in all hospitals in England at the end of 2007.

Some countries are still at the stage of assessing their options. Slovakia, for example, is currently undertaking feasibility studies on various options including a national healthcare information system, different standards for insuring technical (HL7) and semantic interoperability, and health and/or insurance-based ID cards. Bulgaria is also at the stage of choosing a specific direction. Currently, eCards, EHRs, management information systems, and web-services for citizens are all on the policy agenda.

The role of economic evaluation and impact analysis

Two Member States, Ireland and the UK, have reported on actual assessments of some of the socio-economic impact of investments in the eHealth domain. Four Member States, France, Slovenia, Slovakia, Bulgaria, have plans to complete such analyses, which are necessary for optimising resource allocations not only with respect to planned investments, but also for activities already operational. This is one of the directions in which the Financing eHealth study is aiming to support Member States and the EC. The next chapter provides the conceptual framework of eHealth investments and investment decisions.

3 Conceptual framework of eHealth investments

3.1 Defining eHealth

This study aims to assess financing opportunities to boost, protect and manage investment in eHealth. These can only be achieved if there is a reasonable return on that investment, which is usually some form of net benefit, and can only be achieved by investment in a combination of ICT and changes in healthcare. Together, ICT and changes in working practices can lead to potential benefits, and ideally, net benefits. In this context, eHealth investment includes ICT and the resources needed to achieve the changes and improvements in health and healthcare that lead to net benefits. This definition enables financing opportunities for eHealth investment to be considered alongside competing claims for finance for other beneficial investments in healthcare, such as new assets and new drugs. Consequently, eHealth is more than just the implementation and use of ICT in healthcare.

There is no general consensus yet on any particular definition of the term eHealth. Even between documents issued from organs of the EU, the definition of eHealth varies. The "Action Plan for a European eHealth Area" defines and describes eHealth as "the application of information and communications technologies across the whole range of functions that affect the health sector. eHealth tools or solutions include products, systems and services that go beyond simply Internet-based applications. They include tools for health authorities, healthcare provider organisations (HPO) and healthcare professionals at all levels, as well as personalised health systems for patients and citizens. Examples include health information networks, electronic health records, telemedicine services, personal wearable and portable communicable systems, health portals, and many other information and communication technology-based tools assisting prevention, diagnosis, treatment, health monitoring, and lifestyle management"⁵⁸. Similarly, but not identically, the Ministerial Declaration at the EU Ministerial eHealth 2003 conference in May 2003 in Brussels pronounced that "eHealth refers to the use of modern information and communication technologies to meet needs of citizens, patients, healthcare professionals, healthcare providers, as well as policy makers"⁵⁹.

If we allow that "ICT-based tools assisting..." means much the same as "use of modern ICT to meet needs of...", then the main difference in structure between these examples is the way the definition refers to the domain of healthcare. This is a critical issue. In one case reference is made to healthcare processes as "... diagnosis, treatment, health monitoring...", probably with the intention of implying all healthcare processes; in the other case the reference is to individuals and organisations as "... patients, healthcare professionals, healthcare providers..." possibly with the intention of implying all healthcare

⁵⁸ Commission of the European Communities - COM (2004) 356: 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 health care better for European citizens: An action plan for a European e-Health Area, Brussels, 2004-04-30.

⁵⁹

http://europa.eu.int/information_society/eeurope/ehealth/conference/2003/doc/min_dec_22_may_03.pdf

stakeholders. The eHealth definition for this Financing eHealth study is consistent with these two references that refer ICT being used and ICT assisting. The core is that eHealth investment includes the resources needed to use and realise the benefits from ICT. This wider perspective is enhanced in the general trends in eHealth, starting from the 1980s with mainly administrative applications, such as patient administration systems, to the current century, where ICT, such as PACS, that has an impact on improving quality and cost-effectiveness at the point of care, and telecardiology, that leads to a new healthcare model that can improve quality, access and cost-effectiveness of healthcare. Now, ICT can be an integral component of healthcare, hence eHealth.

Today, eHealth mostly assists processes as an external contributing element. This underlies the general position that modern eHealth is not yet widely recognised across the whole healthcare sector as a significant part of the core focus of health policies, strategies, and delivery. It is the comprehensive investment context that we have to address, and hence the definition we adopt for the purposes of the Financing eHealth study is:

eHealth is ICT-enabled change in health services

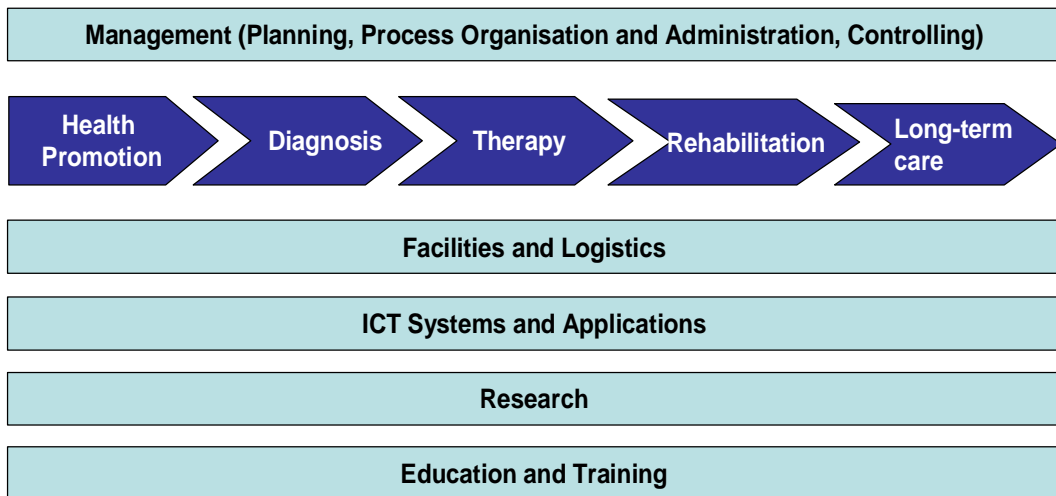
3.2 The healthcare value system and its actors

Healthcare policy makers and strategists will have to devise ways to deliver increasingly complex services to meet increasing demand and expectations for the promotion and maintenance of health, and an expanding range of direct treatments and healthcare. Radical transformation of the healthcare delivery process is needed⁶⁰, supported by and making use of the latest ICT and recognising the reality of increasing consumer influence, probably leading to increasing demand for more personalised healthcare. Healthcare systems constantly evolve to provide a wider range of services, emphasising improvements in health and healthcare, and regarding citizens as independent consumers who can be both inside and outside healthcare services, rather than patients who are within the responsibility of healthcare professionals, especially doctors. Figure 8 shows a schematic model of health and healthcare processes depicted as a healthcare value system.⁶¹

⁶⁰ In line with Jean-Claude Healy's views; Cf. J-C Healy, Integration and Informatics and Communication Technologies (ICT) in the EU national health systems: status and trends, Swiss Medical Informatics (SMI 52), 2004

⁶¹ On the concept of value system cf. Porter, M. Competitive Advantage. New York: The Free Press, 1985, p. 34: "Gaining and sustaining competitive advantage depends on understanding not only a firm's value chain but how the firm fits in the overall value system. ... Competitive advantage is increasingly a function of how well a company [here: a healthcare provider] can manage this entire system. Linkages not only connect activities inside a company but also create interdependencies between a firm and its suppliers and channels."

Figure 8: The healthcare value chain in the healthcare value system



Source: © empirica 2006

The generic core consists of interrelated value chains of individual health service providers, in economic terms ‘producing’ health: promoting good health, providing healthcare and long-term care with the healthcare value chain. Supporting processes and tools are connected to this value chain to create the total healthcare value system. Only as a system of integrated processes, can they lead effectively to healthier, or less ill, citizens.

An eHealth vision for this health value system is to invest in a way that the journey, and experience, of the citizen as they pass through the system is improved with increasing net benefits, and that healthcare professionals will have access to the data, information and knowledge they need to fulfil their role effectively and appropriately. So, eHealth investments, such as interoperable EPRs, will be used to improve both the processes through the value chain, and the supporting care pathways, and also enable citizens and healthcare professionals to take effective decisions between available choices.

Health promotion, as the first element in the core healthcare value chain, refers to the citizen provided with given reliable materials to enable them to exercise life-style choices in a way that improves, or maintains their health. Examples are information on appropriate action to avoid bird flue, the composition of a healthy diet and the importance of tetanus vaccination. Responsibility rests with the public health function, healthcare professionals and citizens themselves. Prevention of illness is included as a part of health promotion.

Diagnosis is the determination of the nature of a disease or injury. It can be clinical, and made from the study of the signs and symptoms of a disease; differential, by determining which of two or more diseases with similar signs and symptom is the one from which a patient is suffering; or laboratory, and made by chemical, microscopic, bacteriologic or biopsy study of secretions, discharges, blood or tissue; or derived from images, such as ultrasound and scans. Each type of diagnosis can be pursued alongside details of patients’ medical and health histories. It is an activity often shared between hospitals, GPs, specialists, and laboratories. EPRs and personal health records (PHR) are key supporting and guiding tools in this process, particularly when they are connected to, and integrated with decision support systems, ePrescribing as part of wider computerised

D1.3: Conceptual framework and context

physician order entry (CPOE) systems, and linked to prognoses based on evidence-based medicine tools.

Three different generic, but in reality often overlapping, forms of medical intervention may follow diagnosis if treatment is needed:

- *Therapy* is the medical or other healthcare, such as nursing and physiotherapy, treatment of illness, probably acute, usually relative short-term, often intensive treatment at this stage of the healthcare value chain
- *Rehabilitation* is part of the process of restoring a patient to good health or useful life, usually through medium-term treatment. In contrast to therapy, it is often more focused on regaining or re-learning specific functions through medium-term interventions and training, and can begin part way through a episode of therapy
- *Long-term care* is the treatment of and care for chronically ill, or disabled people who are not expected to regain totally their previous health status. It focuses on achieving an improved level of quality of life, or maintaining the current status by preventing the worsening of the disease. Where neither of these can be achieved, the goal can be to slow down the rate of deterioration.

The distinction between these three kinds of treatment can be fluid and relates to factors such as the intensity and duration of care and the age of the citizen. EPR, EHR and ePrescribing systems may play a more important, supportive role in these phases of the healthcare value system.

Alongside the citizens, health components of the healthcare value chain are important supporting processes:

- Management includes the strategy, planning, organisation, delivery, control and administration of all health and healthcare services
- Facilities and logistics refer to the procurement, supply, availability, scheduling and performance of all assets, consumables and goods, and ensuring that the right things are at the right place at the right time.
- Research creates opportunities for new or improved ways of delivering health promotion, diagnosis, therapy, rehabilitation and long-term care. In this respect, it is an important instrument changing core health processes.
- Education, training, continuing medical education (CME) and continuing professional development (CPD) are strongly connected to both healthcare provision and clinical and basic research, and creating opportunities to convert research into practice.

Complex eHealth investment can already, and will increasingly, play a central role in binding together and integrating these widely varying actors, functionalities and elements in providing optimal health services to all citizens. In this conceptual framework, eHealth combines the healthcare delivery chain and the supporting tiers. eHealth can impact at every stage of the healthcare value chain and across the whole healthcare value system. This is related to the requirements of sharing information across all tiers. In practice, eHealth investments have to be interoperable, integrated and interconnected, allowing

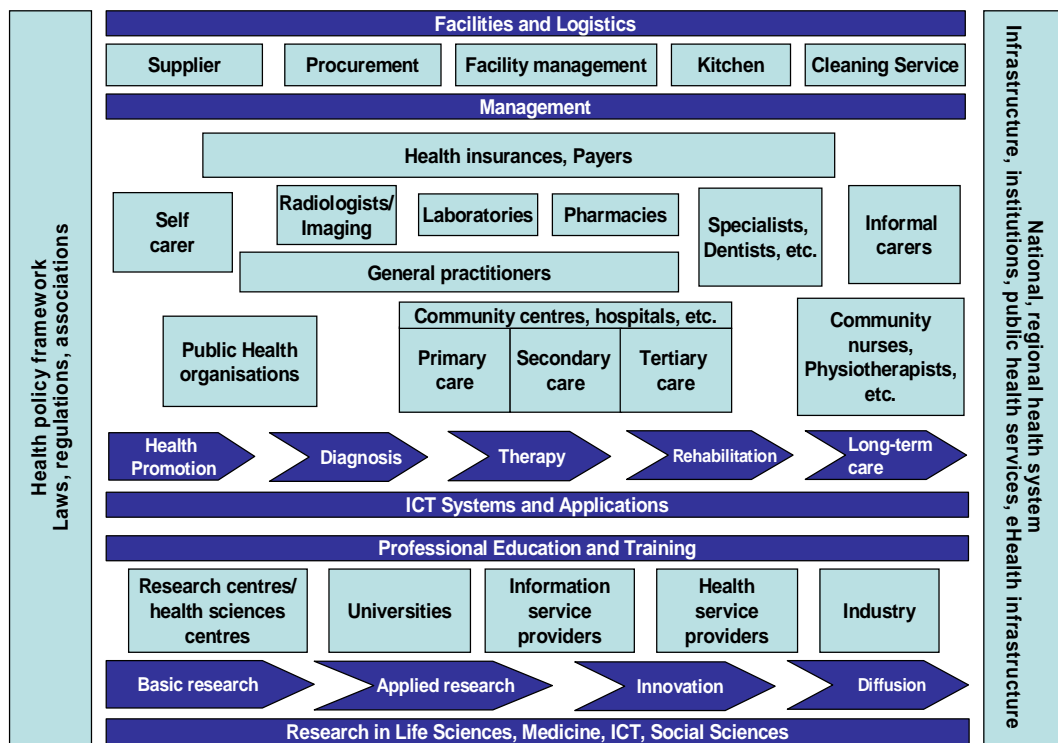
D1.3: Conceptual framework and context

cross-system access to data, in order to share data information and knowledge. This stresses the importance of the interoperability of the various parts of the eHealth setting.

Modern healthcare should focus on making the best use of finite resources in order to balance the health outcomes produced with the needs of all stakeholders in the healthcare arena. Responsibilities and interests of different participants in healthcare are diverse: physicians have interests that differ from those of the citizens who receive treatment. Hospitals differ from a GPs' offices. Health insurances negotiate the payments for medical services with doctors and their associations. Medical care is dependent on data in order to create the basis and transparency for balancing all the different needs and interests of these stakeholders.

Figure 9 maps the processes of the healthcare value system, together with the main organisations involved, to identify the role of information availability and exchange in healthcare. The aim is to illustrate the complexity of information flows: each institution shown needs information from most other organisations, sometimes along several channels. Actual information and data flows within each of these organisations are much more voluminous and complex that conveyed by Figure 9.

Figure 9: Mapping processes to organisations



Source: © empirica 2006

It is not conceivable how all these communication channels can be efficient and effective without eHealth, particularly advanced EPR and EHR systems. For centuries, it has always been communication, the exchange of data, information, and knowledge, which has bound medical and healthcare processes and actors together. More recently, rapid developments in ICT, and solutions based on them, have led to paradigm shift, creating a new quality and scale of such exchanges and interactions.

3.3 Supply of finance for eHealth investment

Assessing finance opportunities to boost eHealth investment has to reflect the general financing context for healthcare in each Member State, as well as the collaborative potential facilitated by activities of the EC and other international institutions.

The **supply side** of eHealth financing comprises a variety of sources. A number of sources are presented in detail in deliverable D2.1 of the Financing eHealth study⁶². Here, a conceptual overview of funds is provided, including:

- Institutional funds, mainly internal priorities and current budgets of direct eHealth investors, such as HPOs
- Regional funds, including public and private sources on sub-national level
- National funds, including support from public and private initiatives and organisations operating on a national scale
- European Commission⁶³ funds
 - Structural Funds
 - Directorate Generals and research programmes, including FP 7
- The European Investment Group: Bank (EIB)⁶⁴ and Fund (EIF)⁶⁵
- International institutions, such as the WHO⁶⁶, the World Bank⁶⁷, or the EEA Financial mechanism⁶⁸.

Opportunities for eHealth financing can rely on an expansion of both capital and revenue finance. Capital can be mainly linked to direct acquisition of hardware components of ICT investment. However, this can be substituted by a revenue model using leasing or Public Private Partnership (PPP). In addition, revenue finance facilitates organisational changes essential for realising the benefits from eHealth.

Additional injections of funds to support non-recurring expenditure, especially at the time of design, development, implementation, and initial roll-out can be drawn from different source. At implementation and roll-out stages, change management will be a critical and resource intensive factor, leading to a temporary increase in expenditure that can extend over several years.

In this context, it is important to stress that the financing options are not mutually exclusive. eHealth investments can, and often must, be financed by a financing package that includes a mix of several sources, including some of those listed above. Each option could cover part of the financial requirements. The optimal mix of financing models for an

⁶² Financing eHealth: D2.1 Pre-report on financing opportunities available to Member States to support and boost investment in eHealth; December 2007

⁶³ <http://ec.europa.eu>

⁶⁴ <http://www.eib.org>

⁶⁵ <http://www.eif.org>

⁶⁶ <http://www.who.int>

⁶⁷ <http://web.worldbank.org>

⁶⁸ <http://www.eeagrants.org>

D1.3: Conceptual framework and context

eHealth investment, or project, over its whole life-cycle should be determined according to its investment profile including the net benefits realisation curve.

Different sources of financing can be classified according to the pre-defined structure outlined in Table 2:

Table 2: Conceptual frame for classifying the supply side of eHealth financing

| | | Source of eHealth Finance | | |
|------------------------------|-----------------------------|---|--|--|
| Summary | | Characteristics | Groups | |
| | | | | |
| | Source supplied by | Level | Institutional | |
| | | | Regional | |
| | | | National | |
| | | | European | |
| | | | Other International | |
| | | Sector | Public | |
| | Private | | | |
| | Public-Private mix | | | |
| | Source aimed at | Scope | National or sub-national | |
| | | | Cross-border | |
| | | | International | |
| | | Focus | Planning, development, experiments, pilots | |
| | | | Start-up, implementation, roll-out | |
| | | | Continuous, routine operation | |
| | | Applicants | SME | |
| | | | HPO | |
| | | | NGO | |
| | | | Public authorities | |
| | Industry | | | |
| | EEA and accession countries | Academic actors | | |
| Yes | | | | |
| No | | | | |
| Conditions | Targeted time scale | Only | | |
| | | Project based/one-off financial injection | | |
| | | General R&D or other experimental budget | | |
| | Type of funds | Part of recurring healthcare financing | | |
| | | Grant | | |
| | | Loan | | |
| | | Guarantee | | |
| Equity | | | | |
| Resource re-allocation | | | | |
| Additional recurring revenue | | | | |
| Comments | | | | |
| Supplier of financing | | | | |

| | Source of eHealth Finance |
|---------------------------------------|---------------------------|
| Short description | |
| Size of financial resources available | |
| Timeline of availability | |
| Conditions / Access path | |
| Contact point | |
| Further information | |

Source: © empirica & TanJent 2007

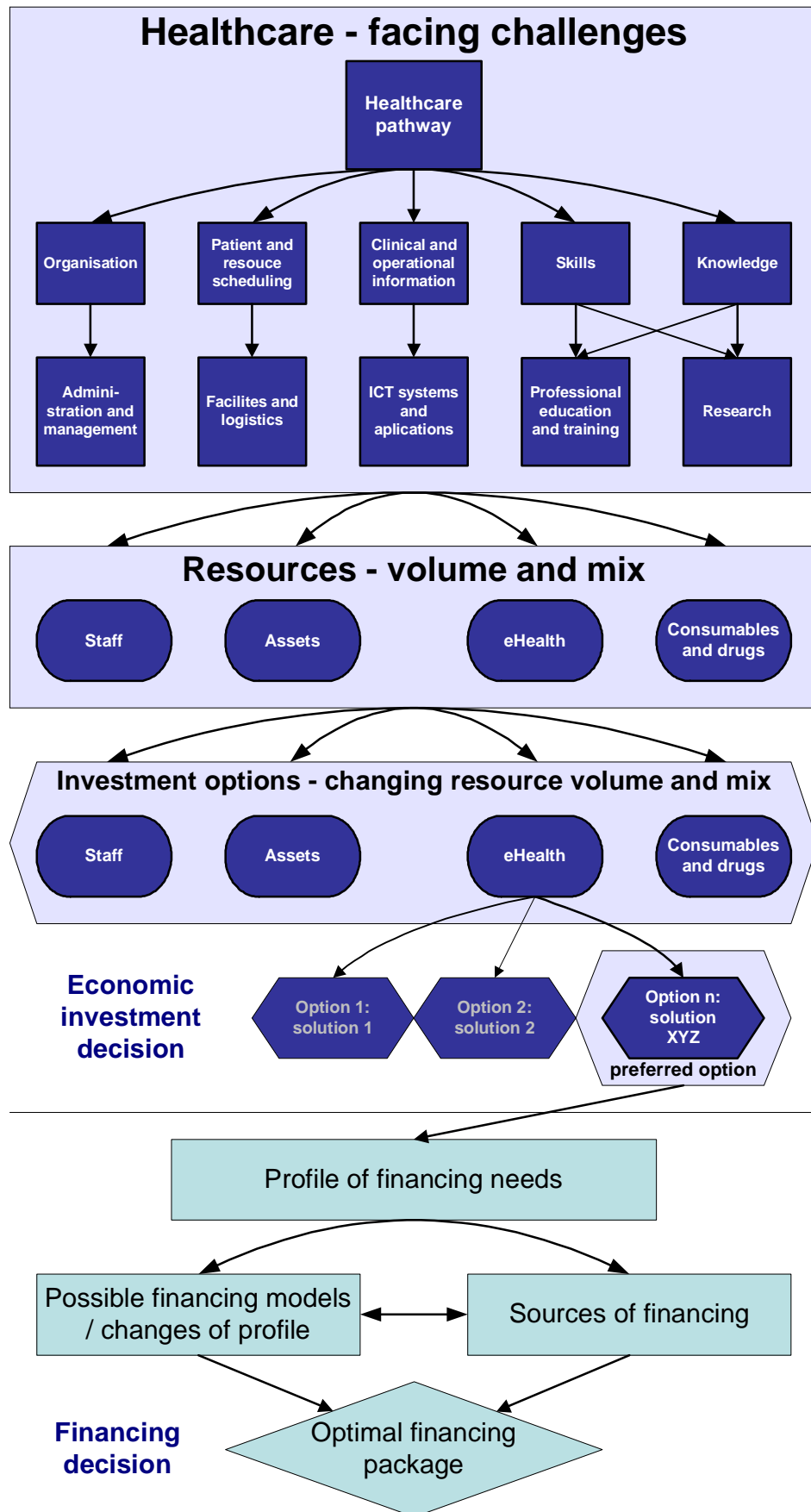
3.4 Demand for finance for eHealth investment

Boosting investment in eHealth involves stimulating the demand for financing. Achieving the former requires an understanding of the factors that affect the demand for finance for eHealth investment; the investment decisions themselves. Classifying different types of investment profiles, with their specific financial needs, defines the **demand side** of financing eHealth investments.

3.4.1 eHealth investment decisions

Developing financing capacity to boost eHealth investment should not be an isolated initiative. *Two types of decisions for investments in general, and healthcare and eHealth in particular are relevant for this study: economic and financial.* Economic decisions have to be made to set relative priorities in the context of Figures 8 and 9. Only when these decisions are made, can the financial implications and needs be rigorously analysed and optimal financing decisions taken. The process of identifying needs and setting priorities that lead from economic to financing decisions are summarised in Figure 10.

Figure 10: The process of economic and financing decisions



Source: © TanJent/empirica 2006

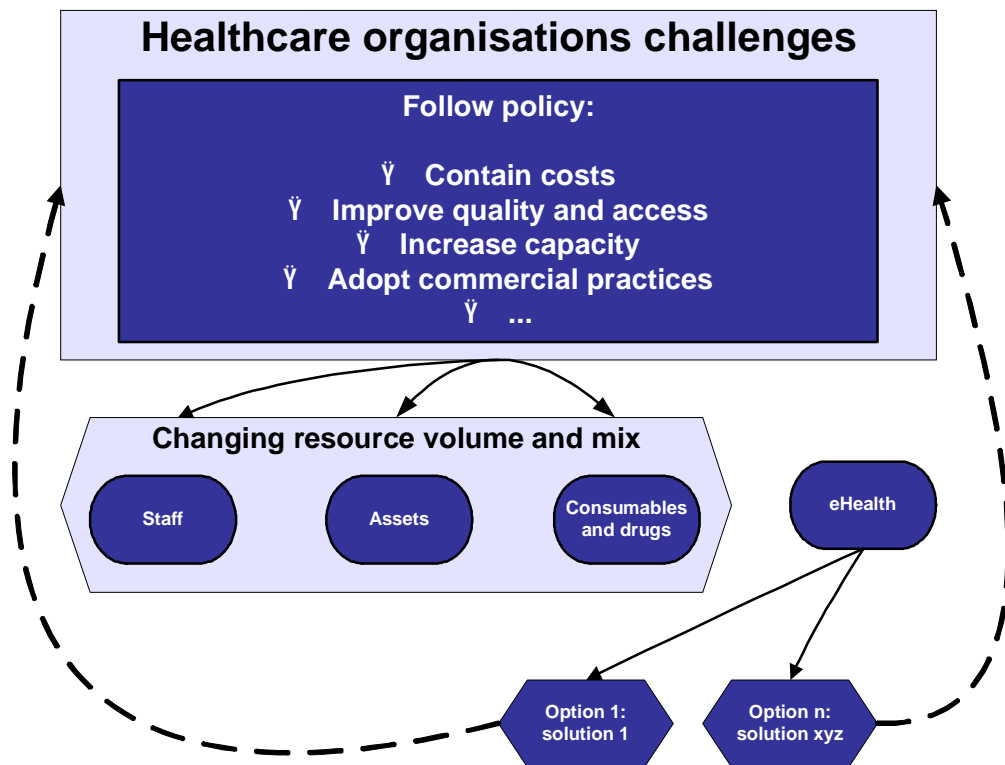
D1.3: Conceptual framework and context

From economic and systems perspectives, eHealth is competing for resources with all other tiers of the healthcare value system. Decision makers have to set their priorities for the change of emphasis among the tiers and allocation of resources, given the objective of meeting the challenges of modern healthcare systems. From this first economic decision, a range of options for, in particular for eHealth, investments becomes clearer. The next step is to design and choose an optimal investment based on an assessment of the potential economic costs and benefits in the strategic context of the investing entity. For eHealth, this means choosing between various types of eHealth applications and solutions, such as EPR, EHR or telecare.

Successfully measuring benefits requires the appropriate benefits matrix to be in place at the outset of the investment. This should be completed as part of the business case for the eHealth investment that is proposed to secure the eHealth finance. In this context, a new relationship needs to be developed that builds from the economic model of cost benefit analysis (CBA) and adds a finance benefits analysis (FBA) that can be used to secure eHealth finance.

For effective eHealth investment, a strategic fit of eHealth and other investments across, and within, each organisation type needs to be achieved. Figure 11 shows a position of eHealth outside this strategic fit.

Figure 11: Sub-optimal position - eHealth pushing into healthcare from the outside



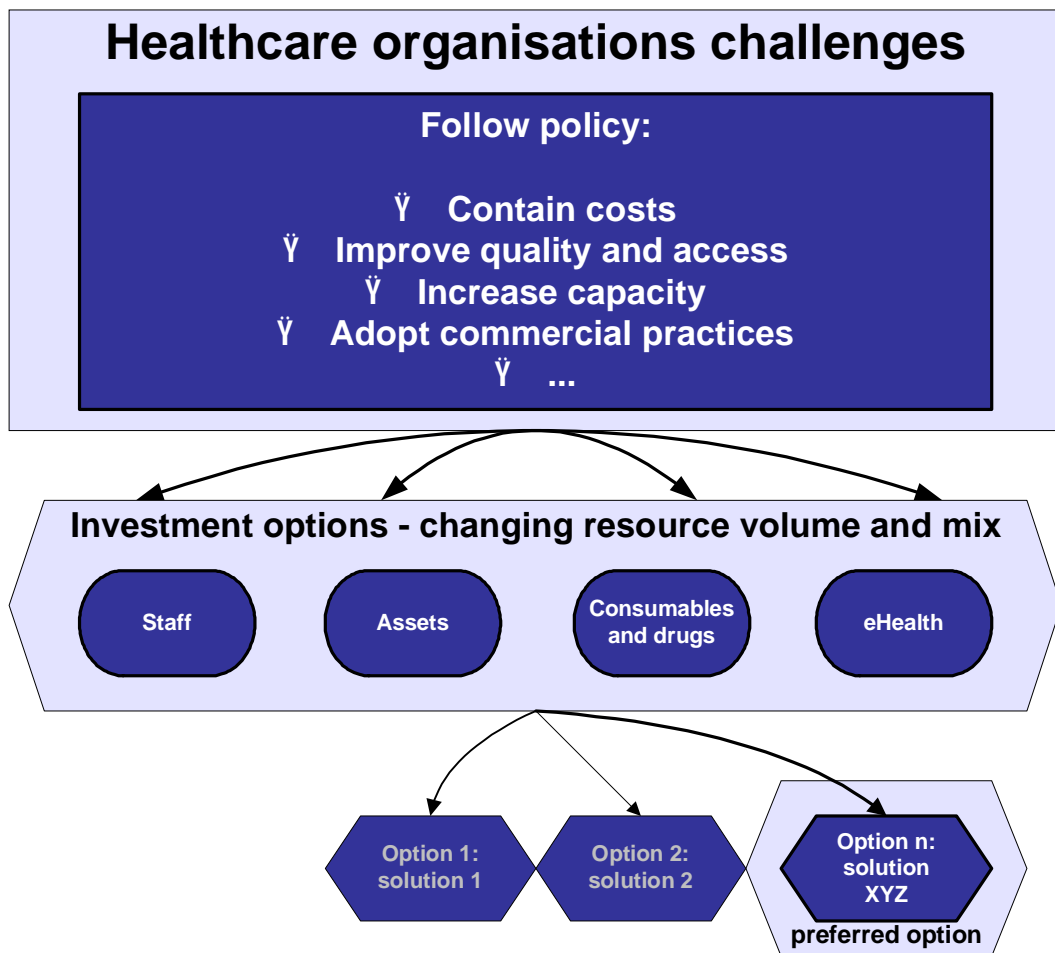
Source: © TanJent/empirica 2006

Organisations providing health services (HPOs) today are under constant pressure to contain costs, improve the quality of and access to their services, and adopt business-like practices in their management and other activities. In order to meet these challenges, HPOs can focus on refining their traditional resource mix, which includes staff, assets, and consumables. eHealth is considered as an parallel factor impacting on healthcare,

but without an explicit, clear role or relative position in the HPO's working and management practices. Figure 11 shows an artificial eHealth demand, pushed by supply. In this setting, which seems to be prevalent in many HPOs, investment decisions on eHealth are taken in isolation from strategic investment decisions.

Natural demand for eHealth as part of the investment portfolio, and thus natural demand for eHealth financing, will only come about from a construct like the one illustrated in the Figure 12. Here, eHealth is drawn into the strategic fit of potential investors and becomes a factor of production. Thus, eHealth can substitute other resources in meeting growing demand. This does not necessarily boost investment in eHealth, but it ensures the appropriateness of eHealth investments. Given the context of increasing demand and increasing resource scarcity described in Chapter 2, and the findings from eHealth IMPACT study⁶⁹, a consequent increase in eHealth investment can be assumed.

Figure 12: Constructive strategic fit - eHealth as an integrated factor of production



Source: © TanJent/empirica 2006

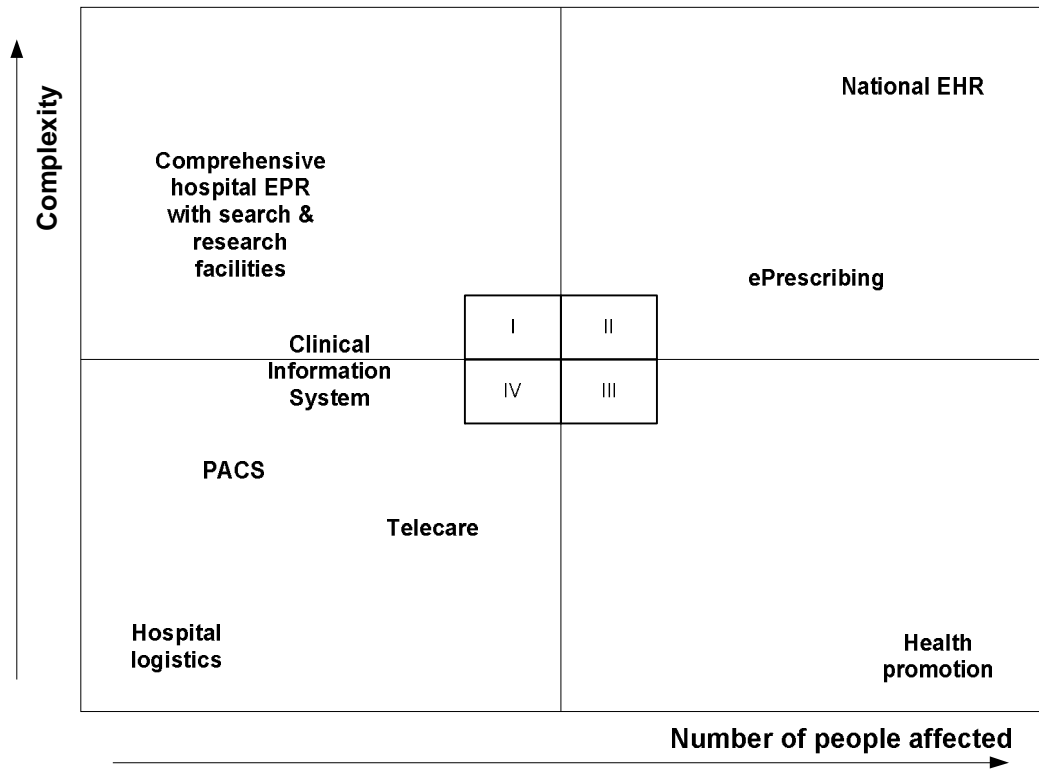
⁶⁹ The eHealth IMPACT study illustrated that eHealth can support more, better, and safer healthcare, within available resources. See www.ehealth-impact.org.

3.4.2 Factors affecting financing options – a typology of eHealth investments

Fisher's theorem of separation states that in efficient capital markets the investment decision is independent of the financing decision⁷⁰. In the setting of eHealth investments, this is not sufficient. Each type of eHealth investment has a profile of resources it requires in terms of type, volume, and timing, which in turn determines the required financing arrangements.

eHealth investments can be classified into profiles that can combine to a typology of eHealth investments, as illustrated in Figure 13 below. Each profile in the typology includes a specific investment curve, which gives an indication of the financing needs. It is important to note again that the investment is in *eHealth*, not just ICT. This implies that the identified profiles and needs include all stakeholders involved.

Figure 13: Typology structure for eHealth investment profiles



Source: © TanJent/empirica 2006

The Y-axis refers to the complexity of the eHealth solution in question. This includes the development, technical, as well as the organisational components of the solution. For example, exchanges of free text messages between a physician's office and a laboratory is a simple application. A comprehensive and structured EHR system is an example of a complex solution. On the X-axis, the determining variable is the number of people affected. An EHR restricted to a hospital has fewer users and affects fewer people than a region-wide or national EHR solution.

⁷⁰ For an article on the topic see "The history of economic thought website": <http://cepa.newschool.edu/het/essays/capital/fisherinvest.htm>

D1.3: Conceptual framework and context

The combination of these two characteristics indicates the financial needs of a particular eHealth investment. Each cell in Figure 13 represents an eHealth solution and investment profile with a specific economic expenditure curve.

A third dimension that emerges from preliminary research is the distribution of effort and risk between users and suppliers of ICT solutions. Broadly, two ways to structure the financing package can be identified: one where the development period needs investment by suppliers and users, illustrated in Table 3, and one where the suppliers have completed the design and development work and supply a completed, proven solution, shown in Table 4. This third dimension goes diagonally across the typology diagram, with eHealth solutions at the lower left in the 4th quadrant tending to follow the latter way of structuring, while activities in the top right of the 2nd quadrant require an arrangement like illustrated in Table 3.

Table 3: Joint development of complex eHealth solutions

| Model 1 - eHealth needing joint development, such as EPR | | | | | | |
|--|-----------------------------------|---------|---------|-----------|---------|--------|
| | External Grants | | --- | --- | --- | |
| | Loans | | | | | --- |
| | Suppliers Life-Cycle Finance | | | | | |
| | Suppliers Direct Finance | | | | | --- |
| | Risk | | | | | --- |
| ICT Suppliers | Plan | Develop | Build | Implement | Operate | --- |
| Interface | Procure | Procure | Procure | Procure | Procure | |
| eHealth Users | Plan | Develop | Build | Implement | Use | Change |
| | Risk | | | | | |
| | Users Direct Finance From Revenue | | | | | |
| | Users Life-Cycle Finance | | | | | |
| | Loans | | | | | --- |
| | External Grants | | | | | --- |

Source: © TanJent/empirica 2006

In this setting, dealing with relationships between costs, benefits, financing, strategic context, and risk will be challenging to estimate and deliver over a long time scale. Finance for eHealth has to be sustainable throughout the period. The financing package would need to cover the whole life-cycle, and difficulties with budgeting over several years need to be overcome by matching realistic timescales and financing demands. Currently, insufficient attention is paid to the change stage and to risk. From an economic perspective, risk is a cost factor that must be financed along with the more tangible items.

On a relatively simplified scale, eHealth products such as PACS can be developed by suppliers then sold to HPOs. This leads to an arrangement where suppliers carry much of the development work and risks. Users procure the product only when it is finished, then implement and operate it, adapting their healthcare models to realise the benefits. Table 4 illustrates this setting.

Table 4: Supplier developed eHealth solutions

| Model 2 - eHealth already developed by suppliers, such as PACS | | | | | | |
|--|---------------------------------------|---------|-------|-----------------|---------|--------|
| | External Grants | | --- | --- | --- | --- |
| | Loans | | | | | --- |
| | Suppliers Life-Cycle Finance | | | | | --- |
| | Suppliers Direct Finance | | | | | --- |
| | Risk | | | | | --- |
| ICT Suppliers | Plan | Develop | Build | Implement | Operate | --- |
| Interface | --- | --- | --- | Procure | Procure | --- |
| eHealth Users | Plan | --- | --- | Implement | Use | Change |
| | Risk | | | | | --- |
| | Users Direct Finance From Revenue | | | | | --- |
| | Users Life-Cycle Finance From Revenue | | | | | --- |
| | Loans | | | | | --- |
| | --- | --- | --- | External Grants | | --- |

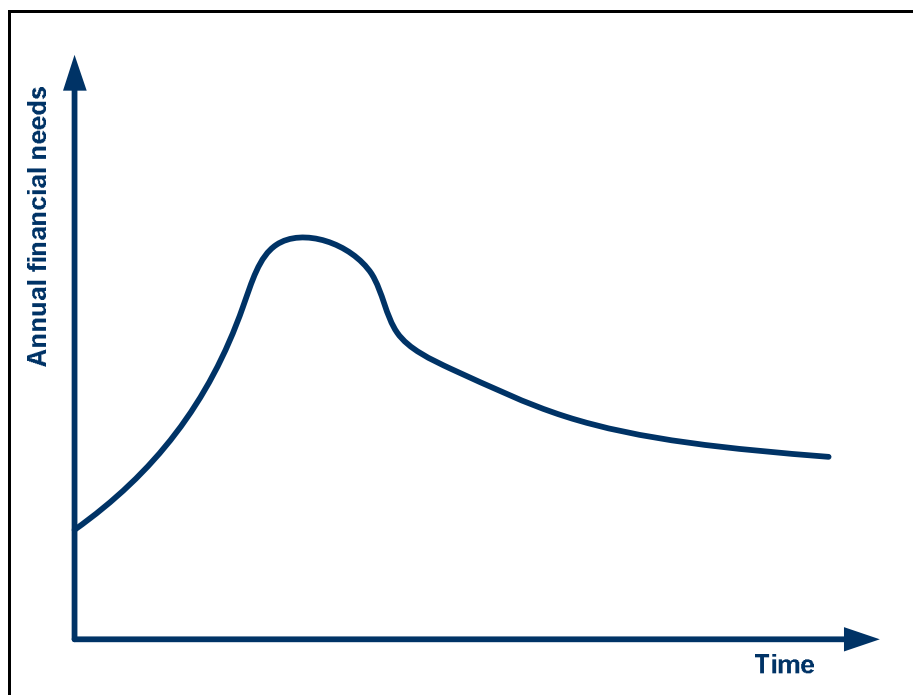
Source: © TanJent/empirica 2006

3.4.3 Financial needs of eHealth investments

Independent of the specific type of eHealth investment discussed above, the financial needs follow a general pattern. There is a financial needs curve, shown in Figure 14, which is identified according to three attributes:

- Shape – height, position and length of hump
- Length of curve
- Position – height of the curve’s starting position, relative to the base.

Figure 14: Example of economic expenditure curve of an eHealth investment



Source: © TanJent/empirica 2006

D1.3: Conceptual framework and context

Every eHealth investment starts with a period of planning and development beginning with the investment plan and then the actual solution design. This can include a significant period of ICT design and development, including specifying information requirements. From the beginning of the design and development period, a bulk of financial resources is required up to the end of implementation and change. Procurement of hardware and equipment, infrastructure building, software development, and sometimes buildings and other facilities, takes place in this phase of the investment. This is represented by the hump in the cost curve. Following this, the application, or solution, entails running costs, such as annual software licences, maintenance and updates of hardware, administrative expenses and new clinical and working practices, with the associated new skills and teams.

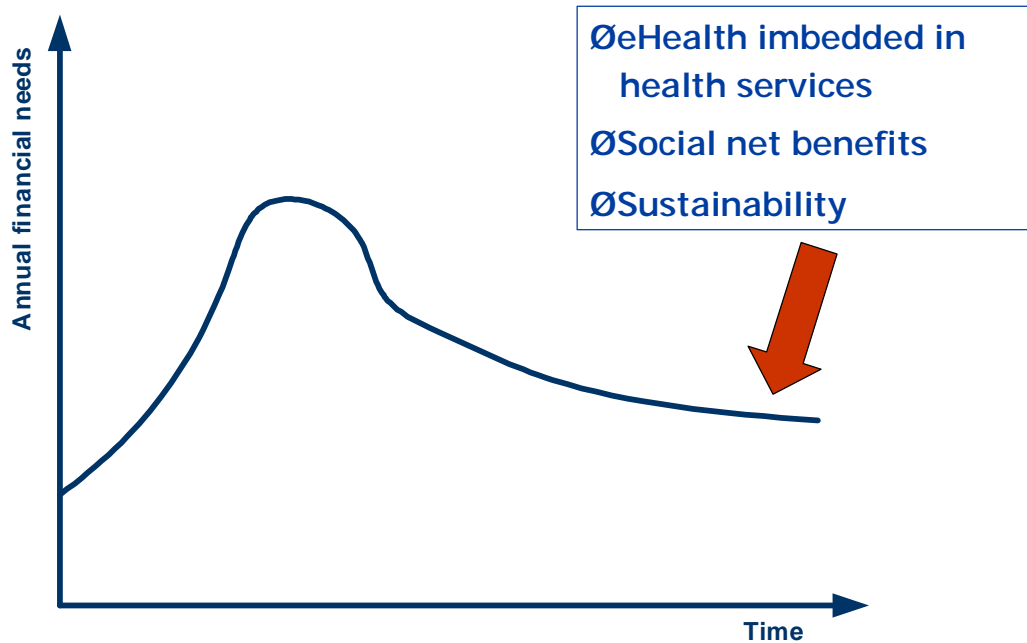
Although often regarded as the whole investment, the size of the hump determines only the timing and volume of the bulk of financial resources required. The total length of the curve represents the investment life-cycle: the time period in which financing is required. The position of the curve in respect to the Y-axis shows the relative volume of funds required on an annual basis. The face of the area below the curve is the total financial requirement over the investment lifecycle.

Each eHealth investment can be divided into three separate sub-investments, each of which represents a specific financing challenge:

- Challenge 1: finance the cost of eHealth development and preparation
- Challenge 2: finance the investment hump in the cost curve usually associated with timing of procurement and implementation
- Challenge 3: finance the consequent annual eHealth running costs and managing eHealth in its role of a production factor.

The third challenge includes restructuring healthcare delivery to ensure sustainable net benefits, realise the financial return and meet increasing demand for healthcare services. This is important, since, as shown in Figure 15 below, the benefits are often realised at the later stage, when eHealth has become a routine part of healthcare delivery and less effective, old processes have been withdrawn.

Figure 15: Timing of sustainable benefit realisation



Source: © TanJent/empirica 2006

Data from the forthcoming field work will indicate the relative weight of the above three parts of the investment lifecycle, giving illustrative shapes of curves for each type of eHealth profile.

Expenditure curves extracted from investment profiles are only the starting point, representing the total financial and financing needs. Financing models can influence the shape of the curve in terms of cash requirements and help to make hump flatter and longer. The curve will still start where it was and the overall volume of financing needs should not change much, yet the balance between one-off and continuous financing can be changed. For example, by taking a loan from a bank, or signing a leasing contract, an eHealth investor can raise the cash needed to finance the hump. As the expenditure curve changes along with the post contractual financing requirements, the eHealth investor needs less cash in the short-run because the hump is much smaller. However, the investor faces higher annual expenditure levels in the longer run in: the flatter, post-hump part of the curve. The overall cost may increase slightly with the inclusion of interest and other charges associated with credits of all kinds.

Once the optimal financing package is selected, investors can start their search for specific sources of financing. Deliverable 2.1 of this study⁷¹ provides initial insights on different sources and choices of financing and financing arrangements available for eHealth investors.

⁷¹ Financing eHealth: D2.1 Pre-report on financing opportunities available to Member States to support and boost investment in eHealth

4 Summary and conclusions

The overview of the wider context of healthcare and eHealth investment involved a high level analysis of features of European health systems and Member States' eHealth policies. The overall observation is that similar challenges are addressed in different ways. Ageing populations, increasing incidence of chronic diseases, and improvements in medical knowledge and technological equipment are the main demand drivers across the EU. However, Member States have different ways of dealing with these demand pressures. Thus, the contexts in which eHealth investments have to be made, and financing secured so that investment can be boosted, protected, and managed, is diverse. We may conclude that there is unlikely to be a one-size-fit-all solution to boosting eHealth investment, such as increasing lump-sum funding.

Stimulating eHealth investment needs to be based on a sound conceptual framework. This report proposes such a framework, building on an analysis of decision making processes and factors characterising different types of investments. At the core of the framework lies the fundamental distinction between economic and financial decisions, coupled with identifying the current and desirable position of eHealth in the resource mix of investors. Currently, eHealth is trying to penetrate and support healthcare from outside the mainstream strategic context. It is essential that in the near future eHealth is considered as a factor of production, and integrated into the strategic resource mix. As a step towards improved understanding of the different needs for financing, a typology of eHealth investments has been compiled. It shows that different types of eHealth activities have different investment curves, which define the different demands for financial resources over the whole investment lifecycles.

The framework will be used to identify current mismatches between supply of and demand for eHealth financing, based on providing insights on the real needs that should drive investments and define appropriateness of supply. This can support efforts towards a switch from supply-pull demand to needs-driven demand for financing, thus stimulating demand and boosting eHealth investment.

5 Disclaimer

This report is part of a study on financing opportunities available to Member States to support and boost investment in eHealth (www.financing-ehealth.eu) commissioned by the European Commission, Directorate General Information Society and Media, Brussels. The content of this paper reflects solely the views of its authors. The European Commission is not liable for any use that may be made of the information contained in the report.

6 Annex: draft glossary

Assets: these are rights or other access to future economic benefits controlled by an entity as a result of past transactions or events. Software can be included with hardware as an asset.

Benefits: the monetary value of the gains in an accounting period from an investment of resources in productive services. Benefits can be tangible, and determined by price or transactions, or intangible, when shadow prices may be used to estimate monetary values. Benefits from eHealth can accrue to several stakeholders, including patients, carers, citizens, healthcare professionals, healthcare organisations and third party payers.

Capital expenditure: expenditure on a project that has a benefit to an entity for more than one of its accounting periods. An example is a one-off expenditure to set up a large computer or communications facility that is expected to operate for five years before it needs to be replaced.

Cash flow: the amount of money either paid out or received by an entity in an accounting period, or group of accounting periods, and either for capital items or annual operating activities. Cash flow is often classified as payments and receipts.

Cost: the monetary value of the resources sacrificed in an accounting period to realise benefits and income from productive services. Costs can be tangible, and determined by price or transactions, or intangible, when shadow prices may be used to estimate monetary value. Costs of eHealth can be incurred by several stakeholders, including patients, carers, citizens, healthcare professionals, healthcare organisations and third party payers.

Depreciation: the measure of the cost or revalued amount of the economic benefits of tangible fixed assets consumed during an accounting period. Capital expenditure and the value of leases excluding interest payments, are usually depreciated each year of the useful life of the associated assets to reflect its use in each accounting period, and so their reduced value at the end of each accounting period. Depreciation is an item of costs.

Discounting: is the technique by which monetary values from different points in time are converted into consistent, comparable measures at a single point of time, usually the present. Usually, it is absolute monetary values in the future that are reduced in order to show their present value, reflecting the opportunity cost of time, mainly interest, utility from consumption now instead of later, and risk. Estimated values of costs and benefits of an activity or project are adjusted using an interest rate that reflects a typical return that can be achieved from a business, service activity or public service. Discounting is particularly important in evaluating long-term investments where the benefits arise much after the point of investment expenditure. It also enables costs of projects with different life cycles to be compared.

eHealth investment profile: the capital and revenue expenditure curve over the life-cycle of a proposed eHealth investment to include planning and development, implementation and operation.

eHealth utilisation: measures of the use of eHealth by an appropriate unit of activity, such as the number of active users, the number of transactions, or the number of live records.

Financing model: an arrangement that provides funds to pay for a planned or actual activity, or project. Two settings for the Financing eHealth study are financing healthcare and financing eHealth. Providing funds for healthcare is achieved by three generic models, public money, such as from taxation, health insurance, either social or voluntary, or direct payment. Each of these can have many different arrangements, as found in the EU Member States. They all operate by transferring funds from citizens to reimburse healthcare providers, often through third party payers. eHealth financing can be part of reimbursement, or include access to additional funds, and can be seen as an arrangement for pay for eHealth investments, or projects, over their whole life. It can have several phases, such as financing for one-off or non-recurring costs of development, implementation or change management, and financing for continuous investment, such as an increase in annual expenditure on operating the eHealth services. Financing arrangements can have precise arrangements for managing the risks of an investment or project.

Financial resources: the volume of money from the various sources of finance for an investment, or project. In the context of eHealth, they are used to pay for the resources needed for a project, such as an ICT team, hardware and software, over its timescale.

Funding: the pot, or pots, of money that can be accessed to finance a proposed investment, or project. It will be available from the source of financing, and on the terms agreed for its use.

Grant: assistance in the form of transfers of cash or assets to an enterprise in return for past or future compliance with certain conditions relating to the operating activities of the enterprise. Income and costs should be matched with one another. In many cases, the grant-making body has the right to recover all or part of a grant paid if the enterprise has not complied with the conditions under which the grant was made. International Accounting Standard (IAS) 20 Accounting for Government Grants and Disclosure of Government Assistance sets out further explanation.

Income: the amount of money due in an accounting period, and related to the sales or activities in the accounting period, or a group of accounting periods, usually the financial year of the entity. An example is the money due for services provided to patients.

Investment: expenditure on an activity, or project, to achieve a return over its proposed life-cycle, such as expenditure on an eHealth application and change management to achieve an improvement in healthcare quality, access or efficiency. It is often comprised of items of capital expenditure, and can also include additional, or re-allocated revenue expenditure. An example is an eHealth project that includes the expenditure on hardware, software and changing the clinical and working practices needed to realise the benefits.

Leasing: access to the use of assets through a lease, which is a contract for a specific asset where the ownership of the asset remains with the entity providing the finance for the lease, and the user pays a rental fee for the rights to use the asset. A finance lease transfers most, or all the risks of using the asset to the user, an operating lease can share the risks. IAS 17 Accounting for leases sets out further explanation.

Life-cycle costs: the total cost of owning or using facilities, assets or services, expressed as items of capital or revenue expenditure needed for an investment, or project, over its whole time period. For an eHealth project, it can extend from planning, development, implementation and operation, and include expenditure on obsolescence, refreshment, upgrading, and changes to capacity to reflect significant change in utilisation.

Liabilities: these are an entity's obligations to transfer economic benefits as a result of past transactions or events.

Monetary value: estimating costs and benefits where prices are not available from commercial transactions. Techniques such as shadow pricing and willingness to pay can be used to help in estimating monetary values.

Private Finance Initiative (PFI): an arrangement where a private sector entity, or group of private sector entities, is responsible as an operator for supplying services that traditionally have been provided by public sector organisations. The operator can design, build, finance and operate the resources needed to provide the service, which can include ICT systems.

Public Private Partnership (PPP): an arrangement where a public healthcare entity has a medium to long-term contractual relationship with a single, or group of private eHealth equipment and related ICT-service suppliers, who provide a range of investments and services that can include some of the expertise of eHealth informatics, information and ICT, to help the healthcare provider to develop and use its eHealth solutions to achieve its long-term healthcare goals. The private suppliers could also be part of a consortium, and they may provide some of their contributions as sponsors, but more usually on an annual or fee-for-service base. Typically, such arrangements are used where private investors have easier access to capital markets than public entities.

Real resources: include the people who are needed for an activity, or project, the equipment and facilities needed throughout the whole time period of a project.

Reimbursement: payments by third party payers to citizens or healthcare providers to pay for all, or part, of the cost of healthcare provided

Revenue expenditure: the amount of money incurred in an accounting period, and related to the activities in the accounting period, or a group of accounting periods, usually the financial year of the entity. It includes spending on operational activities and financing obligations. Examples are the salaries paid to staff and annual licence fees paid to eHealth suppliers for the use of their software.

Risk: this is uncertainty as to the outcome, timing and costs of activities and inactivity, including potential for gain and exposure to loss.

Semi-fixed costs: are resource and expenditure that vary disproportionately to changes in volumes of activity, workload or throughput. Semi-fixed costs are sometimes referred to as stepped costs because they remain flat when throughput increases initially, then increase sharply and directly when the spare capacity has been fully utilised, and begins another flat line until the increased capacity is fully utilised, when another sharp and direct increase in costs is needed. They fit in the context of variable costs, where variable

expenditure changes directly with changes in throughput, and fixed costs which never change with throughput, except in the long-term.

Sources of financing: various types of arrangements that can be available to pay for the costs of an investment, or project, over its whole life. Examples include an increase in spending on eHealth by the entity, an increase in the budget for an internal ICT team to pay for an eHealth development or change management costs; arrangements with banks and institutions to pay for the additional capital or revenue expenditure of a project, such as the European Investment Bank (EIB), leasing arrangements and eHealth suppliers that provide services for an annual fee that includes development and capital expenditure spread over the life of a contract where the payments are classified as revenue expenditure.

Value added: the amount of the net benefits, i.e. benefits minus costs, usually of a proposed project or investment, over a specified time, and often measured by cost benefit analysis and discounted to a net present value. It can be used to identify an optimal option available to an entity. Examples are where the estimated benefits to patients and healthcare providers from an eHealth project exceed its estimated costs over the project's investment life-cycle.